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# Apatite fission track age, length and kinetic parameter (Cl, Dpar) data for the Northrock *et al.* East MacKay I-77 well, central Mackenzie Valley, Northwest Territories

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## Abstract

Apatite fission track (FT) age and length measurements for a sandstone cuttings sample from the Devonian Imperial Formation of the Northrock *et al.* East MacKay I-77 well (64° 46' 41.61" N latitude; 125° 43' 10.28" W longitude) are presented herein. The well is located in the central Mackenzie Valley, Northwest Territories, south of Tulita and east of the MacKay range. Also included are compositional (electron microprobe elemental data) and etch figure size (Dpar) data for apatite age and length grains that are used for defining FT age populations with different thermal annealing behaviour. Two different kinetic populations with pooled FT ages of 90.4±6.1 Ma and 222.2±22.5 Ma are well defined on the basis of Cl content. A Cl value of 0.125 atoms per formula unit (apfu) (0.45 wt%) separates these two FT kinetic populations whereas FT ages show considerable overlap when plotted with respect to the Dpar parameter.


## Introduction

This report presents supplementary data and plots to accompany the paper by Issler *et al.* (*in press*) on a multi-kinetic apatite fission track (FT) thermal history study of the East MacKay I-77 well in the central Mackenzie Valley, Northwest Territories. Data include apatite FT age (Table 1) and length (Table 2) measurements with corresponding kinetic parameter data for a sandstone cuttings sample from the depth interval, 1730-1780 mKB. Also included are elemental data for apatite grains originally collected as wt % (Table 3a) and recalculated in terms of atoms per formula unit (apfu; Table 3b). The I-77 well is situated in the Keele Tectonic Zone (MacLean and Cook, 1999), a region with a history of anomalous subsidence and exhumation throughout the Phanerozoic. The well penetrated Upper Cretaceous foreland strata resting unconformably on Upper Devonian strata of the Imperial Formation. The FT sample is interesting because it consists of two age populations with different thermal annealing properties that permit enhanced resolution of its post-Devonian thermal history. Very little has been published on multi-kinetic apatite FT data; the I-77 data provide a well-documented example.

## Apatite FT Age Data

Table 1 lists apatite grain age information along with the measured kinetic parameters, Cl content (from Table 3b), and Dpar, the arithmetic mean maximum diameter of FT etch figures parallel to the crystallographic c-axis (Donelick, 1993; Burtner *et al.*, 1994). Data acquisition procedures are described in Issler *et al.* (*in press*). Apatite composition is known to affect temperature-dependent FT annealing (e.g. Green *et al.*, 1986; Carlson *et al.*, 1999; Barbarand *et al.*, 2003; Ravenhurst *et al.*, 2003). Generally, increased Cl content causes increased resistance to annealing except at very high concentrations where the trend reverses (Carlson *et al.*, 1999; Gleadow *et al.*, 2002; Kohn *et al.*, 2002). Dpar depends on apatite solubility which in turn is a function of apatite composition; therefore it is a proxy kinetic parameter for FT annealing. Table 1 contains both measured and corrected Dpar values; the correction is meant to compensate for differences in laboratory etching conditions and observer bias so that the data are equivalent to those of Carlson *et al.* (1999) for use with the Ketcham *et al.* (1999) annealing model. Measured Dpar values are multiplied by the ratio of average Dpar values for Durango apatite as reported by Carlson *et al.* (1999) (1.83  m) and as measured in this study (1.74  m). The effect is to increase measured Dpar values by approximately 5%.

OH content has been used as a kinetic parameter for FT annealing by Ketcham *et al.* (1999) and calculated OH values (from Table 3b) are included in Table 1. The parameter, $r_{mro}$, is a measure of the relative resistance to annealing among apatite grains (Table 1). It forms the basis for the multi-kinetic FT annealing model which compares the degree of apatite FT annealing relative to that for the most retentive end-member apatite composition. It is defined as the reduced length of the most resistant apatite at the point where the less resistant apatite first becomes totally annealed. $r_{mro}$ values were calculated using the empirical equation of Carlson *et al.* (1999),

$$r_{mro} = [0.027 + 0.431 abs(Cl - 1) + 0.107 abs(OH - 1) - 1.01 Mn \\ - 2.67 Fe - 0144 others]^{0.25} \quad \textbf{(1)}$$

which uses apfu elemental values in Table 3b for a $Ca_{10}(PO_4)_6F_2$ end-member. Others is the sum of the cations Na, Mg, Sr, Y, Ce and La (Table 3b). $r_{mro}$ is also expressed in terms of Cl and Dpar using the equations (Ketcham *et al.*, 1999, 2000),

$$r_{mro} = 1 - \exp\{2.107[1 - abs(Cl - 1)] - 1.834\} \quad \textbf{(2)}$$

and

$$r_{mro} = 1 - \exp[0.647(Dpar - 1.75) - 1.834] \quad \textbf{(3)}$$

Calculated $r_{mro}$ values from equation 1 were substituted into equations 2 and 3 to obtain calculated Cl and Dpar values for comparison with measured values (Table 1).

A plot of apatite FT grain age versus measured Dpar (Figure 1A) indicates that different age populations cannot be resolved using Dpar; ages are grouped according to their similarity and show considerable overlap with respect to Dpar. In contrast, a younger (90.4±6.1 Ma) and older (222.2±22.5Ma) FT age population are resolved when grain ages are plotted with respect to Cl content (Figure 1B). Three anomalous high Cl grains share attributes of both populations and are likely caved from the Cretaceous section. A plot of Cl versus Dpar for age (Figure 2A) and length (Figure 2B) grains shows considerable scatter; the slopes of the linear regression equations (calculated using the reduced major axis method; e.g. Davis, 1986) are very similar to the relationship deduced from equations 2 and 3 except that the lines are offset by approximately 0.2  m on the Dpar axis. This may indicate that our Dpar correction has not fully compensated for differences between our measurement techniques and those of Carlson *et al.* (1999).

A plot of FT grain age versus number of grid counting squares for track density measurement (Quads; Fig. 3A and Table 1) indicates that the older FT grains are associated to 16 or less grid squares whereas the younger grains span from 4 to 80 grid squares. The number of grid squares is a proxy measure for grain size; thus, older FT grains are silt-sized whereas the younger grains vary from silt- to sand-size. Similarly, high Cl content (with the exception of a few outliers; Fig. 3B and Table 1) is associated with silt-sized grains whereas lower Cl values occur over a broader range of grain sizes. These results are in accord with the multi-stage sample processing history; the older silt-sized fraction was recovered when the sample was reprocessed with new plates on the rock crusher (Issler *et al.*, *in press*). The differences in age, Cl content and grain-size strongly indicates that this sample contains different kinetic populations with different thermal annealing behaviour.

## Apatite FT Length Data

Table 2 contains all the horizontal, confined (etched FTs parallel and below the polished mineral surface) FT length measurements, their orientation with respect to the crystallographic c-axis, and the associated measured and calculated kinetic parameters (Dpar, Cl, OH, $r_{mro}$) as described above. Sixty lengths are associated with kinetic population 1 fluorapatite grains (mean length is 10.73±2.14 µm); kinetic population 2 Cl-rich grains have 111 FT length measurements (mean length is 10.41±1.99 µm). Apatite grains for three additional lengths were not probed but do have Dpar data (Table 2). Most of the length measurements come from two separate grain mounts, irradiated with $^{252}$Cf, to increase the number of etchant pathways for enhanced revelation of horizontal tracks. Additional FT lengths were obtained from three different age mounts (Issler *et al.*, *in press*).

FT annealing is anisotropic (e.g. Green et al., 1986; Galbraith and Laslett, 1988; Galbraith *et al.*, 1990; Donelick, 1991) and therefore horizontal FT lengths can be corrected back to a standard orientation (parallel to crystallographic c-axis) using an appropriate length projection model (Donelick *et al.*, 1999; Ketcham, 2003). A plot of measured FT length (Fig. 4A) and FT lengths projected parallel to the mineral c-axis (Fig. 4B) versus Cl shows little structure in the data, consistent with two kinetic populations that experienced similar degrees of annealing but at different temperatures and times (see modelling results of Issler *et al.*, *in press*). For modelling purposes, the measured track lengths in Table 2 were corrected by Issler *et al.* (*in press*) in a similar manner to the Dpar measurements as described above.

## Apatite Elemental Data

Table 3a lists the raw elemental wt% data obtained from the JEOL electron microprobe at Dalhousie University. Single spot analyses were done using wavelength-dispersive methods with an accelerating voltage of 15 kV, a beam current of approximately 20.6 nA and a beam width of 5 µm (an initial beam width of 10 µm yielded low elemental totals for the silt-sized apatite grains). With a few exceptions, duplicate analyses for selected grains showed good reproducibility (generally 0.01-0.05 wt% for Cl values <0.6 wt%). Table 3a includes some low elemental totals but these data were still useful for sorting the apatite grains into high Cl and low Cl populations. Despite the wide variation in Cl content for kinetic population 2 (0.45 to 2.25 wt%), an effective Cl concentration of 0.21 apfu (0.71 wt%) could be used to model the data (Issler *et al.*, *in press*). This range in Cl content is far greater than the uncertainty in analytical precision on single grain measurements.

Elemental wt% data were converted to apfu (Table 3b) in a spreadsheet assuming a 42 atom total based on the end-member formula, $Ca_{10}(PO_4)_6F_2$, full occupancy of the halogen site (OH determined by iteration using measured O) and various cation substitutions. We used the following standard procedures: (1) elemental wt% values were converted to atomic proportions by dividing by the atomic weight; (2) apfu values were calculated by dividing the atomic proportions by the sum of atomic proportions and multiplying by 42 atoms; (3) OH was calculated iteratively using the criterion, F+Cl+OH=2; (4) O values were adjusting according to the amount of O incorporated into OH. The quality of analyses was judged using the wt% totals and the total for cations and anions based on the idealized apatite formula. Also listed in Table 3b are the kinetic parameters, $r_{mro}$, Cl and Dpar, calculated using equations 1 to 3.

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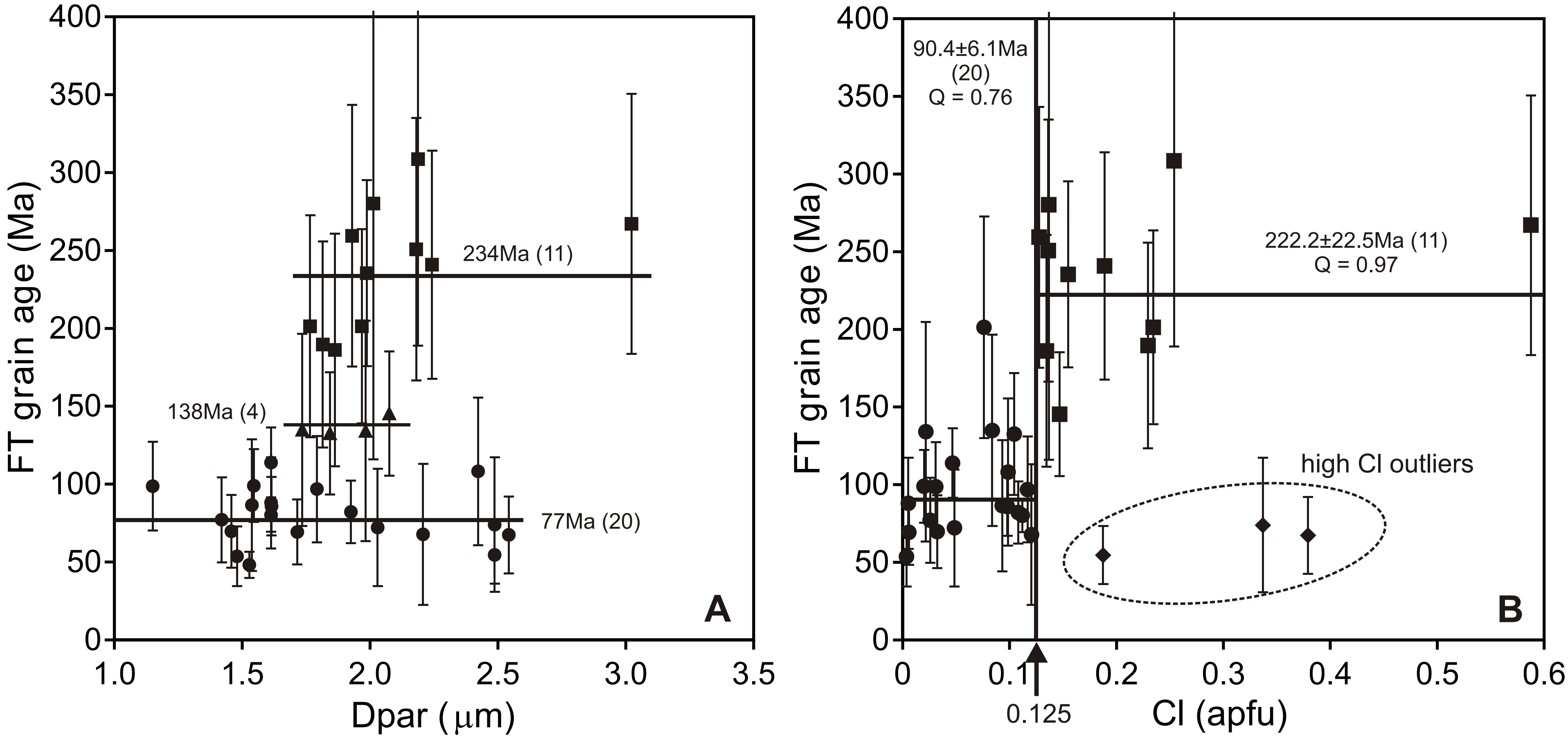


Figure 1. Fission track grain age versus (A) Dpar (etch figure size) and (B) Cl content in atoms per formula unit. (A) Age populations overlap with respect to Dpar; age groupings (number of grains in brackets) are arbitrary and based on sorting grain ages. Intermediate ages could belong to either the younger or older population. (B) Two age populations are separated at 0.125 apfu Cl; younger high Cl grains may be caved from the Cretaceous. Pooled ages (± one standard devitaion) are shown along with $\chi^2$ probabilities (Q).

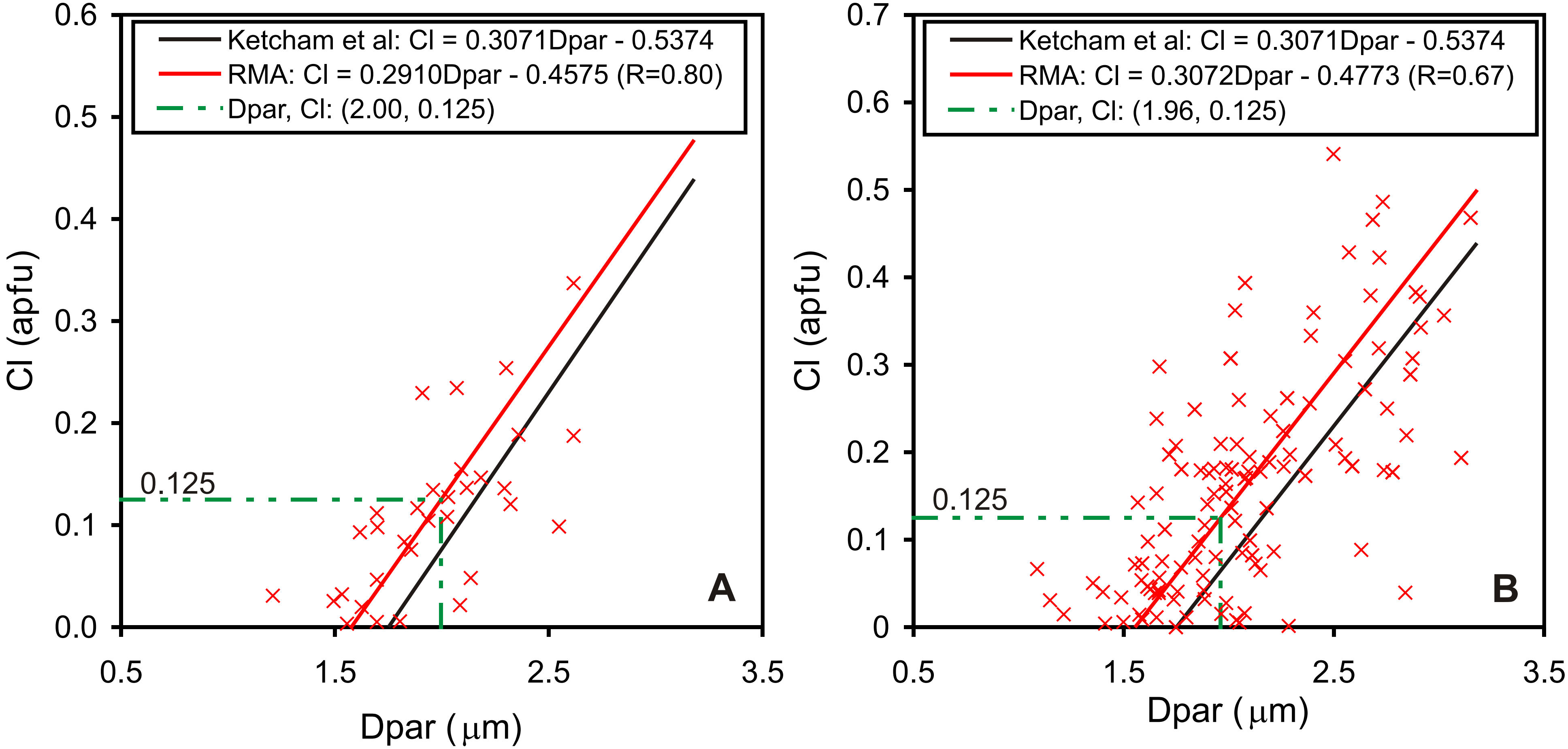


Figure 2. Chlorine content (atoms per formula unit) versus Dpar (etch figure size) for (A) FT age grains and (B) FT length measurements for the East MacKay I-77 FT sample. Solid black lines are derived from published equations of Ketcham *et al.* (1999) (their Fig. 7). Solid red lines are from the reduced major axis (RMA) regression of the plotted data (x symbols). For the RMA line, a Cl value of 0.125 apfu equates with a Dpar value of 2.

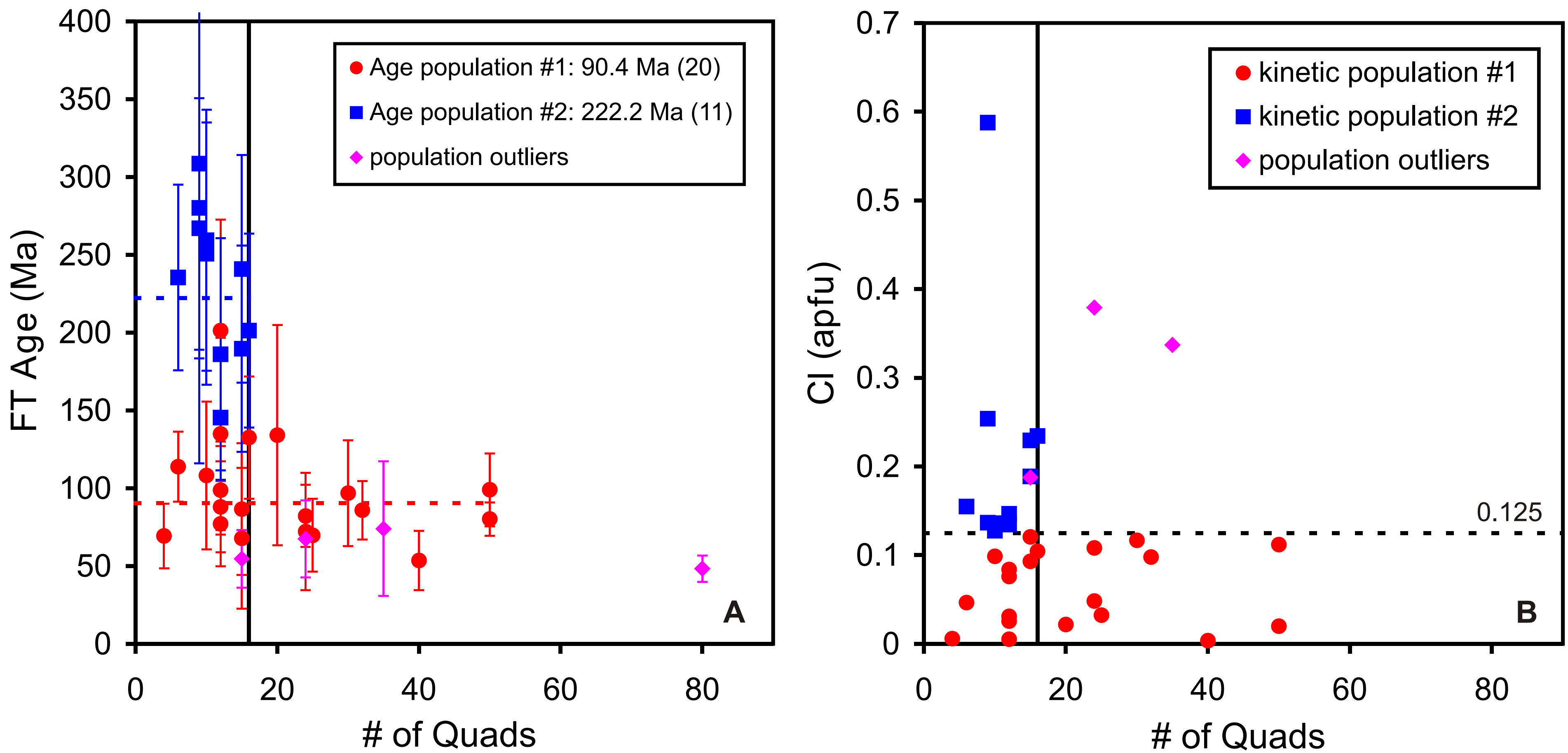


Figure 3. Relation between grain size, Cl content and fission track age. (A) Fission track age versus number of squares on counting grid (quads). Older, Cl-rich grains (solid blue squares) are associated with 16 or less quads (silt sized); younger, Cl-poor grains (solid red dots) span a broader range of quads (silt to sand size). Vertical bars represent one standard deviation on grain age. (B) Cl content (atoms per formula unit) of age grains versus number of quads. Plot shows that high Cl grains (except for three outliers - see Fig. 1) are associated with a smaller number of quads than lower Cl grains.

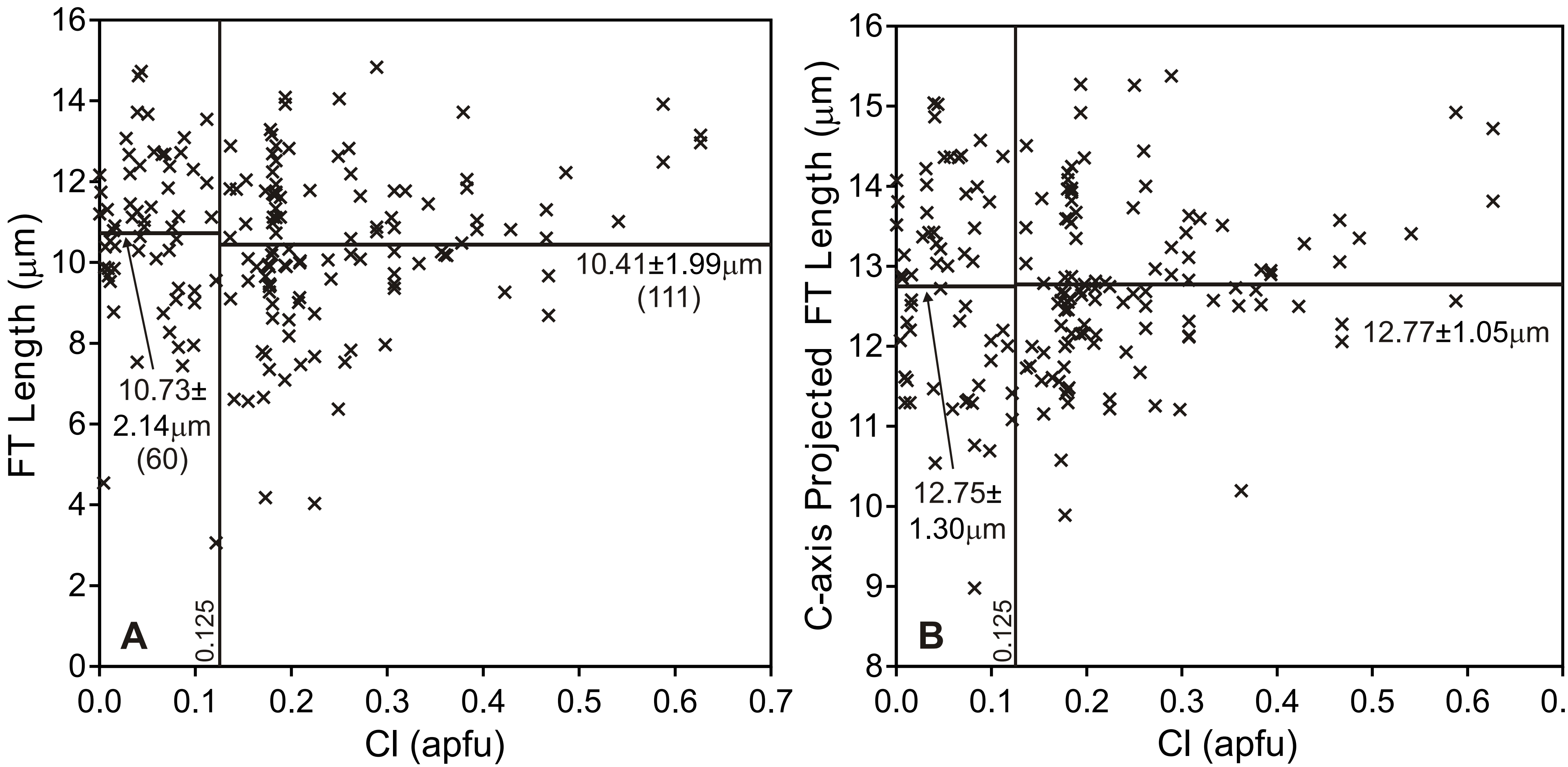


Figure 4. (A) Measured FT length and (B) calculated FT length projected parallel to the crystallographic c-axis versus measured Cl content in atoms per formula unit. The vertical line at 0.125 apfu Cl divides two separate kinetic populations; horizontal lines show the mean track length for each population. Numbers in brackets are the number of length measurements per population.

**Table 1. Apatite fission track age and kinetic parameter data, East MacKay I-77 sample.**

| [1]Grain No. | [2]Auto-scan No. | $N_s$ | [3]$N_i$ | [4]Quads | U (ppm) | Measured Cl (wt%) | Measured Cl (apfu) | [5]FT age (Ma) | [6]Meas. Dpar (μm) | [7]Corr. Dpar (μm) | [8]Calc. OH (apfu) | [9]$r_{mro}$ | [10]Calc. Dpar (μm) | [10]Calc. Cl (apfu) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **young outlier age (reset or caved?)** | | | | | | | | | | | | | | | |
| 1 | 2 | 41 | 172 | 80 | 12 | - | - | 48.3 ± 8.5 | 1.53 | 1.61 | - | - | - | - | mt#2 |
| **kinetic population #1** | | | | | | | | | | | | | | | |
| 2 | 19 | 10 | 37.77[a] | 40 | 5 | 0.0128 | 0.0036 | 53.6 ± 19.1 | 1.48 | 1.56 | 0.0935 | 0.8364 | 1.79 | 0.0112 | mt#3 |
| 3 | 1 | 13 | 29.82[a] | 12 | 14 | 0.0191 | 0.0053 | 88.0 ± 29.3 | 1.61 | 1.70 | 0.0974 | 0.8222 | 1.92 | 0.0507 | mt#3 |
| 4 | 8 | 15 | 43.73[a] | 4 | 60 | 0.0203 | 0.0058 | 69.3 ± 20.8 | 1.72 | 1.80 | 0.1197 | 0.8392 | 1.76 | 0.0032 | mt#3 |
| 5 | 1 | 27 | 55 | 50 | 6 | 0.0699 | 0.0199 | 99.0 ± 23.4 | 1.55 | 1.62 | 1.0812 | 0.7594 | 2.38 | 0.1943 | mt#1 |
| 6 | 7 | 6 | 9 | 20 | 2 | 0.0773 | 0.0217 | 134.1 ± 70.8 | 1.98 | 2.09 | 1.2022 | 0.8037 | 2.07 | 0.0977 | mt#1 |
| 7 | 2 | 11 | 28.82[a] | 12 | 13 | 0.0927 | 0.0257 | 77.1 ± 27.4 | 1.42 | 1.49 | 0.0694 | 0.8333 | 1.82 | 0.0201 | mt#3 |
| 8 | 6 | 18 | 36.78[a] | 12 | 17 | 0.1107 | 0.0310 | 98.7 ± 28.5 | 1.15 | 1.21 | 0.0000 | 0.8254 | 1.89 | 0.0422 | len grn 6, mt#3 |
| 9 | 24 | 12 | 34.79[a] | 25 | 8 | 0.1167 | 0.0323 | 69.7 ± 23.4 | 1.46 | 1.53 | 0.0000 | 0.7953 | 2.13 | 0.1176 | mt#3 |
| 10 | 39 | 41 | 72.56[a] | 6 | 66 | 0.1686 | 0.0466 | 113.8 ± 22.4 | 1.61 | 1.70 | 0.4489 | 0.8168 | 1.96 | 0.0648 | len grn 39, mt#3 |
| 11 | 8 | 5 | 14 | 24 | 3 | 0.1710 | 0.0483 | 72.2 ± 37.7 | 2.03 | 2.14 | 1.0426 | 0.7299 | 2.56 | 0.2492 | mt#1 |
| 12 | 43 | 16 | 15.90[a] | 12 | 7 | 0.2709 | 0.0760 | 201.3 ± 71.3 | 1.77 | 1.86 | 0.1987 | 0.8239 | 1.90 | 0.0461 | mt#3 |
| 13 | 7 | 8 | 11.93[a] | 12 | 5 | 0.2974 | 0.0838 | 134.9 ± 61.7 | 1.74 | 1.82 | 0.3524 | 0.7707 | 2.31 | 0.1715 | mt#3 |
| 14 | 13 | 6 | 14 | 15 | 5 | 0.3242 | 0.0931 | 86.5 ± 42.3 | 1.54 | 1.62 | 0.7301 | 0.7549 | 2.41 | 0.2031 | mt#1 |
| 15 | 5 | 30 | 70.57[a] | 32 | 12 | 0.3529 | 0.0979 | 85.8 ± 18.8 | 1.62 | 1.70 | 0.2487 | 0.7614 | 2.37 | 0.1904 | len grn 5, mt#3 |
| 16 | 16 | 8 | 14.91[a] | 10 | 8 | 0.3559 | 0.0987 | 108.2 ± 47.4 | 2.42 | 2.55 | 0.9539 | 0.7124 | 2.66 | 0.2791 | mt#3 |
| 17 | 11 | 19 | 28.82[a] | 16 | 10 | 0.3658 | 0.1044 | 132.6 ± 39.3 | 1.84 | 1.94 | 1.0355 | 0.7752 | 2.28 | 0.1621 | mt#3 |
| 18 | 11 | 24 | 59 | 24 | 13 | 0.3769 | 0.1082 | 82.2 ± 20.0 | 1.93 | 2.02 | 0.5446 | 0.7298 | 2.56 | 0.2494 | mt#1 |
| 19 | 3 | 81 | 204 | 50 | 22 | 0.3902 | 0.1118 | 80.2 ± 10.7 | 1.61 | 1.70 | 0.7408 | 0.7089 | 2.68 | 0.2848 | len grn 3, mt # 2 |
| 20 | 3 | 12 | 25 | 30 | 5 | 0.4078 | 0.1167 | 96.8 ± 34.1 | 1.79 | 1.89 | 0.9129 | 0.7080 | 2.68 | 0.2863 | len grn 3, mt#1 |
| 21 | 10 | 3 | 8.95[a] | 15 | 3 | 0.4330 | 0.1206 | 67.8 ± 45.2 | 2.21 | 2.32 | 0.8708 | 0.6891 | 2.78 | 0.3160 | 3 pits, mt#3 |
| **90.4 ± 6.1[b]** | | | | | | | | | | | | | | | |
| **kinetic population #2** | | | | | | | | | | | | | | | |
| 22 | 44 | 22 | 16.90[a] | 10 | 9 | 0.4680 | 0.1276 | 259.4 ± 84 | 1.93 | 2.03 | 0.0284 | 0.7747 | 2.28 | 0.1632 | mt#3 |
| 23 | 17 | 12 | 12.92[a] | 12 | 6 | 0.4683 | 0.1345 | 186.1 ± 74.6 | 1.86 | 1.96 | 0.5508 | 0.7038 | 2.70 | 0.2930 | mt#3 |
| 24 | 37 | 20 | 15.90[a] | 10 | 9 | 0.4938 | 0.1361 | 250.7 ± 84.3 | 2.18 | 2.29 | 0.6033 | 0.7612 | 2.37 | 0.1908 | len grn 37, mt#3 |
| 25 | 3 | 7 | 4.97[a] | 9 | 3 | 0.4461 | 0.1366 | 280.1 ± 164.2 | 2.01 | 2.12 | 0.5746 | 0.7391 | 2.51 | 0.2327 | len grn 3, mt#3 |
| 26 | 23 | 23 | 31.81[a] | 12 | 14 | 0.5149 | 0.1467 | 145.3 ± 39.9 | 2.08 | 2.18 | 0.4395 | 0.7671 | 2.33 | 0.1790 | mt#3 |
| 27 | 48 | 34 | 28.82[a] | 6 | 26 | 0.5483 | 0.1549 | 235.4 ± 59.8 | 1.99 | 2.09 | 0.5122 | 0.7852 | 2.21 | 0.1404 | len grn 48, mt#3 |
| 28 | 22 | 24 | 19.88[a] | 15 | 7 | 0.5586 | 0.1887 | 240.8 ± 73.2 | 2.24 | 2.36 | 0.2746 | 0.7034 | 2.71 | 0.2936 | mt#3 |
| 29 | 15 | 16 | 16.90[a] | 15 | 6 | 0.8091 | 0.2294 | 189.7 ± 66.2 | 1.82 | 1.91 | 0.5261 | 0.7308 | 2.56 | 0.2476 | mt#3 |
| 30 | 12 | 21 | 20.87[a] | 16 | 7 | 0.7667 | 0.2344 | 201.3 ± 62.3 | 1.97 | 2.07 | 0.5608 | 0.6984 | 2.73 | 0.3016 | mt#3 |
| 31 | 33 | 17 | 10.93[a] | 9 | 7 | 0.8360 | 0.2539 | 308.5 ± 119.6 | 2.19 | 2.30 | 0.6774 | 0.6942 | 2.75 | 0.3080 | mt#3 |
| 32 | 20 | 24 | 17.89[a] | 9 | 11 | 1.7202 | 0.5877 | 267.1 ± 83.5 | 3.02 | 3.18 | 0.7122 | 0.4670 | 3.61 | 0.5718 | len grn 20, mt#3 |
| **222.2 ± 22.5[c]** | | | | | | | | | | | | | | | |
| **high Cl outlier ages (caved?)** | | | | | | | | | | | | | | | |
| 33 | 18 | 11 | 40.75[a] | 15 | 15 | 0.6750 | 0.1876 | 54.6 ± 18.6 | 2.49 | 2.62 | 0.5387 | 0.7323 | 2.55 | 0.2449 | mt#3 |
| 34 | 27 | 4 | 10.93[a] | 35 | 2 | 1.1940 | 0.3370 | 73.9 ± 43.2 | 2.49 | 2.62 | 0.6061 | 0.6684 | 2.88 | 0.3465 | mt#3 |
| 35 | 2 | 10 | 30 | 24 | 7 | 1.2995 | 0.3791 | 67.4 ± 24.7 | 2.54 | 2.67 | 0.9001 | 0.6071 | 3.14 | 0.4270 | len grn 2, mt#1 |

[1]All analyses by A. Grist with zeta calibration factor, 353.5±7.1, relative to CN5 glass dosimeter ($N_{d12}$=4281, $\rho_{d12}$=1.15x$10^6$ for age mounts 1 and 2; $N_{d3}$=5387, $\rho_{d3}$=1.157x$10^6$ for age mount 3)

[2]Autoscan number used for locating grains for microprobe measurements

[3]Number of induced tracks for grains from age mount 3 (denoted by a) were adjusted to compensate for different irradiation conditions so that all counts could be pooled ($N_i$ x $\rho_{d12}/\rho_{d3}$)

[4]Number of quadrants (each of area, 9.31 x $10^{-7}$ $cm^2$) used on counting grid

[5]Age ± one standard deviation; pooled ages, b - pass $\chi^2$ test, Q = 0.76 and c - pass $\chi^2$ test, Q = 0.97

[6]Average etch figure size parallel to c-axis measured by A. Grist (1.74 μm for Durango apatite)

[7]Corrected by reference to Carlson *et al*. (1999) Durango apatite Dpar value (1.83 μm)

[8]OH concentration calculated using microprobe data (Table 3)

[9]Kinetic parameter calculated using full probe data (Table 3) in equation 6 of Carlson *et al*. (1999)

[10]Calculated using $r_{mro}$ value and equations 4a,b of Ketcham *et al.* (2000)

**Table 2. Apatite fission track length and kinetic parameter data, East MacKay I-77 sample.**

| [1]Track No. | [2]Auto-scan No. | Confined length (μm) | Angle to C-axis (degrees) | [3]Meas. Dpar (μm) | [4]Corr. Dpar (μm) | [5]Meas. Cl (apfu) | [6]Calc. OH (apfu) | [7]$r_{mro}$ | [8]Calc. Dpar (μm) | [8]Calc. Cl (apfu) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **kinetic population #1 (<0.125 apfu Cl)** | | | | | | | | | | | |
| 1 | 5 | 11.20 | 83.71 | 1.66 | 1.75 | 0.0001 | 0.3259 | 0.8303 | 1.84 | 0.0287 | age mt #1 |
| 2 | 5 | 12.16 | 77.54 | 1.66 | 1.75 | 0.0001 | 0.3259 | 0.8303 | 1.84 | 0.0287 | age mt #1 |
| 3 | 27 | 11.74 | 76.73 | 2.17 | 2.28 | 0.0016 | 0.6436 | 0.8346 | 1.80 | 0.0164 | Cf mt #2 |
| 4 | 22 | 4.54 | 83.63 | 1.34 | 1.41 | 0.0042 | 0.0000 | 0.8159 | 1.97 | 0.0673 | Cf mt #2 |
| 5 | 19 | 9.88 | 87.41 | 1.95 | 2.05 | 0.0055 | 0.0000 | 0.8490 | 1.66 | -0.0268 | Cf mt #2 |
| 6 | 59 | 10.38 | 67.56 | 1.43 | 1.50 | 0.0060 | 0.3040 | 0.8221 | 1.92 | 0.0510 | Cf mt #2 |
| 7 | 43 | 11.31 | 53.16 | 1.94 | 2.04 | 0.0082 | 0.1843 | 0.8509 | 1.64 | -0.0329 | Cf mt #2 |
| 8 | 8 | 9.67 | 32.86 | 1.51 | 1.59 | 0.0090 | 0.0000 | 0.8577 | 1.57 | -0.0551 | Cf mt #2 |
| 9 | 8 | 9.85 | 37.21 | 1.51 | 1.59 | 0.0090 | 0.0000 | 0.8577 | 1.57 | -0.0551 | Cf mt #2 |
| 10 | 55 | 10.53 | 42.82 | 1.71 | 1.80 | 0.0113 | 0.1874 | 0.8297 | 1.85 | 0.0303 | Cf mt #2 |
| 11 | 14 | 9.53 | 41.34 | 1.58 | 1.66 | 0.0113 | 0.4128 | 0.8018 | 2.08 | 0.1023 | Cf mt #1 |
| 12 | 56 | 10.79 | 16.15 | 1.50 | 1.57 | 0.0144 | 0.0000 | 0.8466 | 1.69 | -0.0195 | Cf mt #2 |
| 13 | 26 | 8.77 | 66.06 | 1.16 | 1.21 | 0.0147 | 0.0000 | 0.8229 | 1.91 | 0.0488 | Cf mt #1 |
| 14 | 8 | 9.85 | 67.28 | 1.87 | 1.96 | 0.0153 | 0.4980 | 0.7976 | 2.12 | 0.1123 | age mt #2 |
| 15 | 34 | 10.40 | 69.73 | 2.08 | 2.18 | 0.0160 | 0.0000 | 0.8088 | 2.03 | 0.0853 | age mt #3 |
| 16 | 34 | 10.90 | 43.50 | 2.08 | 2.18 | 0.0160 | 0.0000 | 0.8088 | 2.03 | 0.0853 | age mt #3 |
| 17 | 35 | 13.07 | 17.68 | 1.99 | 2.09 | 0.0277 | 0.3580 | 0.8196 | 1.94 | 0.0575 | age mt #3 |
| 18 | 6 | 12.67 | 62.22 | 1.15 | 1.21 | 0.0310 | 0.0000 | 0.8254 | 1.89 | 0.0422 | age mt #3 |
| 19 | 29 | 12.20 | 69.45 | 1.65 | 1.74 | 0.0319 | 0.3911 | 0.7967 | 2.12 | 0.1143 | Cf mt #2 |
| 20 | 16 | 11.45 | 83.36 | 1.79 | 1.89 | 0.0322 | 0.4366 | 0.8267 | 1.88 | 0.0385 | Cf mt #2 |
| 21 | 11 | 11.12 | 76.79 | 1.42 | 1.49 | 0.0341 | 0.3064 | 0.7782 | 2.26 | 0.1556 | Cf mt #1 |
| 22 | 22 | 7.53 | 49.64 | 1.57 | 1.65 | 0.0391 | 0.4088 | 0.8260 | 1.88 | 0.0405 | Cf mt #1 |
| 23 | 12 | 11.26 | 69.37 | 1.59 | 1.67 | 0.0392 | 0.3122 | 0.8095 | 2.02 | 0.0834 | age mt #2 |
| 24 | 15 | 13.72 | 77.62 | 2.70 | 2.84 | 0.0395 | 0.7025 | 0.7811 | 2.24 | 0.1495 | Cf mt #2 |
| 25 | 21 | 14.62 | 22.31 | 1.33 | 1.40 | 0.0404 | 0.1119 | 0.8246 | 1.89 | 0.0444 | Cf mt #2 |
| 26 | 14 | 10.29 | 9.55 | 1.67 | 1.76 | 0.0407 | 0.7568 | 0.7944 | 2.14 | 0.1198 | age mt #2 |
| 27 | 40 | 12.40 | 32.47 | 1.59 | 1.67 | 0.0421 | 0.3850 | 0.8266 | 1.88 | 0.0389 | Cf mt #2 |
| 28 | 26 | 10.64 | 69.40 | 1.88 | 1.98 | 0.0424 | 0.4388 | 0.8186 | 1.95 | 0.0601 | age mt #3 |
| 29 | 24 | 14.73 | 25.68 | 1.55 | 1.63 | 0.0435 | 0.0000 | 0.7985 | 2.11 | 0.1102 | Cf mt #1 |
| 30 | 39 | 11.04 | 44.94 | 1.61 | 1.70 | 0.0466 | 0.4489 | 0.8168 | 1.96 | 0.0648 | age mt #3 |
| 31 | 39 | 10.88 | 71.60 | 1.61 | 1.70 | 0.0466 | 0.4489 | 0.8168 | 1.96 | 0.0648 | age mt #3 |
| 32 | 2 | 13.67 | 35.39 | 1.29 | 1.35 | 0.0504 | 0.0522 | 0.7952 | 2.13 | 0.1179 | Cf mt #1 |
| 33 | 13 | 11.37 | 46.67 | 1.59 | 1.67 | 0.0538 | 0.7599 | 0.8032 | 2.07 | 0.0990 | age mt #3 |
| 34 | 11 | 12.74 | 70.46 | 1.59 | 1.67 | 0.0568 | 0.1412 | 0.8261 | 1.88 | 0.0403 | Cf mt #2 |
| 35 | 14 | 10.09 | 25.35 | 1.79 | 1.88 | 0.0591 | 0.0677 | 0.7509 | 2.44 | 0.2108 | Cf mt #2 |
| 36 | 6 | 12.67 | 73.52 | 2.05 | 2.15 | 0.0652 | 0.8783 | 0.7275 | 2.58 | 0.2534 | age mt #1 |
| 37 | 9 | 8.74 | 69.59 | 1.04 | 1.09 | 0.0666 | 0.6112 | 0.7968 | 2.12 | 0.1140 | age mt #2 |
| 38 | 15 | 12.68 | 76.21 | 1.69 | 1.77 | 0.0683 | 0.1548 | 0.8055 | 2.05 | 0.0933 | Cf mt #1 |
| 39 | 42 | 11.84 | 41.07 | 1.48 | 1.55 | 0.0716 | 0.5823 | 0.7964 | 2.12 | 0.1151 | Cf mt #2 |
| 40 | 10 | 10.30 | 53.81 | 2.02 | 2.13 | 0.0727 | 0.6027 | 0.7244 | 2.59 | 0.2587 | Cf mt #1 |
| 41 | 1 | 12.38 | 55.42 | 1.51 | 1.59 | 0.0731 | 0.0000 | 0.8119 | 2.00 | 0.0774 | Cf mt #2 |
| 42 | 1 | 8.27 | 44.63 | 1.51 | 1.59 | 0.0731 | 0.0000 | 0.8119 | 2.00 | 0.0774 | Cf mt #2 |
| 43 | 44 | 10.87 | 15.46 | 1.60 | 1.68 | 0.0754 | 0.4222 | 0.7678 | 2.33 | 0.1774 | Cf mt #2 |
| 44 | 47 | 9.08 | 41.55 | 1.75 | 1.84 | 0.0797 | 0.6641 | 0.8176 | 1.95 | 0.0629 | Cf mt #2 |
| 45 | 1 | 10.58 | 74.00 | 1.84 | 1.94 | 0.0804 | 1.0591 | 0.7346 | 2.53 | 0.2409 | age mt #2 |
| 46 | 36 | 9.36 | 26.73 | 2.01 | 2.11 | 0.0822 | 0.3775 | 0.8163 | 1.97 | 0.0663 | Cf mt #2 |
| 47 | 36 | 11.14 | 82.92 | 2.01 | 2.11 | 0.0822 | 0.3775 | 0.8163 | 1.97 | 0.0663 | Cf mt #2 |
| 48 | 36 | 7.90 | 14.50 | 2.01 | 2.11 | 0.0822 | 0.3775 | 0.8163 | 1.97 | 0.0663 | Cf mt #2 |

| [1]Track No. | [2]Auto-scan No. | Confined length (μm) | Angle to C-axis (degrees) | [3]Meas. Dpar (μm) | [4]Corr. Dpar (μm) | [5]Meas. Cl (apfu) | [6]Calc. OH (apfu) | [7]$r_{mro}$ | [8]Calc. Dpar (μm) | [8]Calc. Cl (apfu) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 18 | 12.72 | 48.94 | 1.96 | 2.06 | 0.0850 | 0.8199 | 0.7282 | 2.57 | 0.2521 | Cf mt #1 |
| 50 | 12 | 7.44 | 50.86 | 2.11 | 2.21 | 0.0866 | 0.7147 | 0.8066 | 2.04 | 0.0906 | Cf mt #1 |
| 51 | 50 | 13.09 | 68.79 | 2.63 | 2.77 | 0.0884 | 0.9192 | 0.7198 | 2.62 | 0.2666 | age mt #3 |
| 52 | 5 | 12.30 | 53.16 | 1.62 | 1.70 | 0.0979 | 0.2487 | 0.7614 | 2.37 | 0.1904 | age mt #3 |
| 53 | 17 | 7.95 | 33.94 | 1.77 | 1.86 | 0.0981 | 0.1409 | 0.7529 | 2.42 | 0.2070 | Cf mt #1 |
| 54 | 45 | 9.29 | 61.00 | 2.00 | 2.10 | 0.0993 | 0.0000 | 0.8113 | 2.01 | 0.0789 | Cf mt #2 |
| 55 | 45 | 9.00 | 54.96 | 2.00 | 2.10 | 0.0993 | 0.0000 | 0.8113 | 2.01 | 0.0789 | Cf mt #2 |
| 56 | 3 | 11.97 | 12.45 | 1.61 | 1.70 | 0.1118 | 0.7408 | 0.7089 | 2.68 | 0.2848 | age mt #2 |
| 57 | 3 | 13.54 | 40.04 | 1.61 | 1.70 | 0.1118 | 0.7408 | 0.7089 | 2.68 | 0.2848 | age mt #2 |
| 58 | 3 | 11.12 | 25.35 | 1.79 | 1.89 | 0.1167 | 0.9129 | 0.7080 | 2.68 | 0.2863 | age mt #1 |
| 59 | 5 | 9.55 | 37.23 | 1.93 | 2.03 | 0.1216 | 0.8839 | 0.7488 | 2.45 | 0.2148 | age mt #2 |
| 60 | 5 | 3.06 | 60.67 | 1.93 | 2.03 | 0.1216 | 0.8839 | 0.7488 | 2.45 | 0.2148 | age mt #2 |
| | | **10.73** | | **1.73** | **1.82** | **0.053** | | | **2.09** | **0.104** | **mean** |
| | | **2.14** | | **0.31** | **0.33** | **0.035** | | | **0.28** | **0.087** | **stand. dev.** |
| **kinetic population #2 (>0.125 apfu Cl)** | | | | | | | | | | | |
| 61 | 37 | 10.62 | 69.94 | 2.18 | 2.29 | 0.1361 | 0.6033 | 0.7612 | 2.37 | 0.1908 | age mt #3 |
| 62 | 37 | 11.82 | 53.24 | 2.18 | 2.29 | 0.1361 | 0.6033 | 0.7612 | 2.37 | 0.1908 | age mt #3 |
| 63 | 3 | 12.88 | 75.78 | 2.01 | 2.12 | 0.1366 | 0.5746 | 0.7391 | 2.51 | 0.2327 | age mt #3 |
| 64 | 3 | 9.10 | 52.52 | 2.01 | 2.12 | 0.1366 | 0.5746 | 0.7391 | 2.51 | 0.2327 | age mt #3 |
| 65 | 35 | 6.61 | 59.65 | 1.81 | 1.90 | 0.1404 | 0.0000 | 0.7304 | 2.56 | 0.2483 | Cf mt #2 |
| 66 | 18 | 11.81 | 10.88 | 1.49 | 1.57 | 0.1426 | 0.0000 | 0.7639 | 2.35 | 0.1853 | Cf mt #2 |
| 67 | 16 | 10.95 | 19.05 | 1.84 | 1.93 | 0.1524 | 0.0000 | 0.7710 | 2.31 | 0.1708 | Cf mt #1 |
| 68 | 6 | 12.04 | 64.40 | 1.58 | 1.66 | 0.1529 | 0.9885 | 0.7548 | 2.41 | 0.2032 | age mt #2 |
| 69 | 48 | 10.09 | 76.79 | 1.99 | 2.09 | 0.1549 | 0.5122 | 0.7852 | 2.21 | 0.1404 | age mt #3 |
| 70 | 48 | 9.54 | 31.84 | 1.99 | 2.09 | 0.1549 | 0.5122 | 0.7852 | 2.21 | 0.1404 | age mt #3 |
| 71 | 48 | 6.56 | 64.82 | 1.99 | 2.09 | 0.1549 | 0.5122 | 0.7852 | 2.21 | 0.1404 | age mt #3 |
| 72 | 62 | 9.89 | 36.44 | 1.89 | 1.99 | 0.1639 | 0.5116 | 0.7940 | 2.14 | 0.1206 | Cf mt #2 |
| 73 | 53 | 7.79 | 79.23 | 1.97 | 2.07 | 0.1697 | 0.0000 | 0.7442 | 2.48 | 0.2233 | Cf mt #2 |
| 74 | 19 | 6.66 | 54.24 | 1.98 | 2.08 | 0.1709 | 0.5416 | 0.7978 | 2.11 | 0.1118 | Cf mt #1 |
| 75 | 61 | 11.77 | 26.65 | 2.25 | 2.36 | 0.1731 | 0.7711 | 0.7657 | 2.34 | 0.1816 | Cf mt #2 |
| 76 | 61 | 9.65 | 79.92 | 2.25 | 2.36 | 0.1731 | 0.7711 | 0.7657 | 2.34 | 0.1816 | Cf mt #2 |
| 77 | 61 | 7.72 | 70.75 | 2.25 | 2.36 | 0.1731 | 0.7711 | 0.7657 | 2.34 | 0.1816 | Cf mt #2 |
| 78 | 61 | 4.18 | 38.25 | 2.25 | 2.36 | 0.1731 | 0.7711 | 0.7657 | 2.34 | 0.1816 | Cf mt #2 |
| 79 | 28 | 9.95 | 38.52 | 1.81 | 1.91 | 0.1762 | 0.6342 | 0.7754 | 2.28 | 0.1617 | Cf mt #2 |
| 80 | 1 | 7.35 | 78.12 | 2.64 | 2.78 | 0.1772 | 0.6684 | 0.7189 | 2.62 | 0.2681 | Cf mt #1 |
| 81 | 1 | 9.89 | 86.26 | 2.64 | 2.78 | 0.1772 | 0.6684 | 0.7189 | 2.62 | 0.2681 | Cf mt #1 |
| 82 | 1 | 9.27 | 80.07 | 2.64 | 2.78 | 0.1772 | 0.6684 | 0.7189 | 2.62 | 0.2681 | Cf mt #1 |
| 83 | 1 | 9.40 | 56.66 | 2.64 | 2.78 | 0.1772 | 0.6684 | 0.7189 | 2.62 | 0.2681 | Cf mt #1 |
| 84 | 1 | 9.47 | 10.87 | 2.64 | 2.78 | 0.1772 | 0.6684 | 0.7189 | 2.62 | 0.2681 | Cf mt #1 |
| 85 | 21 | 9.43 | 38.97 | 2.05 | 2.15 | 0.1778 | 0.2949 | 0.7907 | 2.17 | 0.1281 | Cf mt #1 |
| 86 | 60 | 13.29 | 18.74 | 1.99 | 2.09 | 0.178 | 0.4930 | 0.7405 | 2.50 | 0.2302 | Cf mt #2 |
| 87 | 11 | 10.19 | 28.54 | 1.78 | 1.87 | 0.1794 | 0.8945 | 0.7376 | 2.52 | 0.2355 | age mt #2 |
| 88 | 26 | 13.16 | 35.43 | 2.60 | 2.74 | 0.1796 | 0.2985 | 0.7801 | 2.24 | 0.1517 | Cf mt #2 |
| 89 | 12 | 12.69 | 58.60 | 1.92 | 2.01 | 0.1804 | 0.8998 | 0.6802 | 2.82 | 0.3293 | age mt #1 |
| 90 | 12 | 10.98 | 12.50 | 1.92 | 2.01 | 0.1804 | 0.8998 | 0.6802 | 2.82 | 0.3293 | age mt #1 |
| 91 | 12 | 12.24 | 73.02 | 1.92 | 2.01 | 0.1804 | 0.8998 | 0.6802 | 2.82 | 0.3293 | age mt #1 |
| 92 | 12 | 11.70 | 62.28 | 1.92 | 2.01 | 0.1804 | 0.8998 | 0.6802 | 2.82 | 0.3293 | age mt #1 |
| 93 | 37 | 8.62 | 61.80 | 1.69 | 1.77 | 0.1805 | 0.0000 | 0.7945 | 2.14 | 0.1195 | Cf mt #2 |
| 94 | 37 | 10.28 | 56.31 | 1.69 | 1.77 | 0.1805 | 0.0000 | 0.7945 | 2.14 | 0.1195 | Cf mt #2 |
| 95 | 37 | 8.97 | 73.63 | 1.69 | 1.77 | 0.1805 | 0.0000 | 0.7945 | 2.14 | 0.1195 | Cf mt #2 |
| 96 | 30 | 11.12 | 13.93 | 1.84 | 1.93 | 0.1812 | 0.4913 | 0.7703 | 2.31 | 0.1723 | Cf mt #2 |

| [1]Track No. | [2]Auto-scan No. | Confined length (μm) | Angle to C-axis (degrees) | [3]Meas. Dpar (μm) | [4]Corr. Dpar (μm) | [5]Meas. Cl (apfu) | [6]Calc. OH (apfu) | [7]$r_{mro}$ | [8]Calc. Dpar (μm) | [8]Calc. Cl (apfu) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 9 | 11.66 | 29.43 | 1.89 | 1.99 | 0.1826 | 0.0805 | 0.7452 | 2.47 | 0.2216 | Cf mt #2 |
| 98 | 4 | 11.33 | 75.83 | 2.15 | 2.26 | 0.1837 | 0.5539 | 0.7462 | 2.47 | 0.2197 | Cf mt #2 |
| 99 | 41 | 12.52 | 52.06 | 2.46 | 2.59 | 0.1841 | 0.7230 | 0.7060 | 2.69 | 0.2895 | Cf mt #2 |
| 100 | 41 | 10.73 | 57.60 | 2.46 | 2.59 | 0.1841 | 0.7230 | 0.7060 | 2.69 | 0.2895 | Cf mt #2 |
| 101 | 41 | 11.74 | 79.03 | 2.46 | 2.59 | 0.1841 | 0.7230 | 0.7060 | 2.69 | 0.2895 | Cf mt #2 |
| 102 | 41 | 11.93 | 87.88 | 2.46 | 2.59 | 0.1841 | 0.7230 | 0.7060 | 2.69 | 0.2895 | Cf mt #2 |
| 103 | 41 | 11.11 | 29.06 | 2.46 | 2.59 | 0.1841 | 0.7230 | 0.7060 | 2.69 | 0.2895 | Cf mt #2 |
| 104 | 41 | 12.88 | 55.86 | 2.46 | 2.59 | 0.1841 | 0.7230 | 0.7060 | 2.69 | 0.2895 | Cf mt #2 |
| 105 | 33 | 11.61 | 71.39 | 2.09 | 2.19 | 0.1887 | 0.6905 | 0.7049 | 2.70 | 0.2912 | Cf mt #2 |
| 106 | 33 | 11.12 | 70.20 | 2.09 | 2.19 | 0.1887 | 0.6905 | 0.7049 | 2.70 | 0.2912 | Cf mt #2 |
| 107 | 39 | 7.09 | 69.77 | 2.43 | 2.55 | 0.1932 | 0.8355 | 0.6050 | 3.15 | 0.4296 | Cf mt #2 |
| 108 | 39 | 9.93 | 77.57 | 2.43 | 2.55 | 0.1932 | 0.8355 | 0.6050 | 3.15 | 0.4296 | Cf mt #2 |
| 109 | 13 | 13.92 | 53.97 | 2.95 | 3.11 | 0.1936 | 1.5580 | 0.6862 | 2.79 | 0.3204 | age mt #2 |
| 110 | 13 | 14.09 | 78.51 | 2.95 | 3.11 | 0.1936 | 1.5580 | 0.6862 | 2.79 | 0.3204 | age mt #2 |
| 111 | 48 | 9.90 | 73.99 | 2.00 | 2.10 | 0.1947 | 0.2889 | 0.7737 | 2.29 | 0.1652 | Cf mt #2 |
| 112 | 58 | 12.82 | 64.90 | 2.18 | 2.29 | 0.1974 | 0.4605 | 0.7497 | 2.44 | 0.2130 | Cf mt #2 |
| 113 | 38 | 8.58 | 84.92 | 1.63 | 1.72 | 0.1975 | 0.4578 | 0.7463 | 2.46 | 0.2194 | Cf mt #2 |
| 114 | 38 | 10.33 | 45.73 | 1.63 | 1.72 | 0.1975 | 0.4578 | 0.7463 | 2.46 | 0.2194 | Cf mt #2 |
| 115 | 38 | 8.18 | 66.47 | 1.63 | 1.72 | 0.1975 | 0.4578 | 0.7463 | 2.46 | 0.2194 | Cf mt #2 |
| 116 | 13 | 9.01 | 60.69 | 1.66 | 1.75 | 0.2074 | 0.5115 | 0.7450 | 2.47 | 0.2218 | Cf mt #2 |
| 117 | 9 | 9.99 | 76.68 | 2.39 | 2.51 | 0.2088 | 0.8512 | 0.7119 | 2.66 | 0.2798 | age mt #1 |
| 118 | 9 | 9.13 | 77.54 | 2.39 | 2.51 | 0.2088 | 0.8512 | 0.7119 | 2.66 | 0.2798 | age mt #1 |
| 119 | 6 | 10.04 | 84.43 | 1.94 | 2.04 | 0.2092 | 0.5254 | 0.7376 | 2.52 | 0.2354 | Cf mt #1 |
| 120 | 31 | 7.47 | 67.99 | 1.87 | 1.96 | 0.2097 | 0.4266 | 0.7041 | 2.70 | 0.2925 | Cf mt #2 |
| 121 | 20 | 11.78 | 32.13 | 2.71 | 2.84 | 0.2193 | 0.7130 | 0.7010 | 2.72 | 0.2974 | Cf mt #1 |
| 122 | 13 | 8.73 | 83.81 | 2.15 | 2.26 | 0.2243 | 0.1201 | 0.7560 | 2.40 | 0.2010 | Cf mt #1 |
| 123 | 13 | 4.03 | 60.94 | 2.15 | 2.26 | 0.2243 | 0.1201 | 0.7560 | 2.40 | 0.2010 | Cf mt #1 |
| 124 | 13 | 7.67 | 43.84 | 2.15 | 2.26 | 0.2243 | 0.1201 | 0.7560 | 2.40 | 0.2010 | Cf mt #1 |
| 125 | 20 | 10.06 | 62.31 | 1.58 | 1.66 | 0.2384 | 0.0000 | 0.7683 | 2.32 | 0.1764 | Cf mt #2 |
| 126 | 5 | 9.59 | 50.12 | 2.09 | 2.20 | 0.2414 | 0.5728 | 0.7228 | 2.60 | 0.2615 | Cf mt #2 |
| 127 | 23 | 12.63 | 41.20 | 1.75 | 1.84 | 0.2489 | 0.2232 | 0.7671 | 2.33 | 0.1788 | Cf mt #2 |
| 128 | 23 | 6.37 | 87.89 | 1.75 | 1.84 | 0.2489 | 0.2232 | 0.7671 | 2.33 | 0.1788 | Cf mt #2 |
| 129 | 2 | 14.05 | 81.85 | 2.62 | 2.75 | 0.25 | 0.7731 | 0.6700 | 2.87 | 0.3443 | Cf mt #2 |
| 130 | 25 | 7.53 | 54.64 | 2.27 | 2.38 | 0.2559 | 0.6874 | 0.7488 | 2.45 | 0.2147 | Cf mt #2 |
| 131 | 57 | 12.82 | 72.39 | 1.95 | 2.05 | 0.2599 | 0.1535 | 0.7938 | 2.14 | 0.1212 | Cf mt #2 |
| 132 | 49 | 7.83 | 78.15 | 2.28 | 2.40 | 0.2619 | 0.8502 | 0.7204 | 2.62 | 0.2656 | age mt #3 |
| 133 | 49 | 10.59 | 39.61 | 2.28 | 2.40 | 0.2619 | 0.8502 | 0.7204 | 2.62 | 0.2656 | age mt #3 |
| 134 | 49 | 12.19 | 68.40 | 2.28 | 2.40 | 0.2619 | 0.8502 | 0.7204 | 2.62 | 0.2656 | age mt #3 |
| 135 | 49 | 10.20 | 64.74 | 2.28 | 2.40 | 0.2619 | 0.8502 | 0.7204 | 2.62 | 0.2656 | age mt #3 |
| 136 | 9 | 10.08 | 26.25 | 2.52 | 2.65 | 0.2719 | 0.3739 | 0.7370 | 2.52 | 0.2365 | Cf mt #1 |
| 137 | 9 | 11.64 | 39.64 | 2.52 | 2.65 | 0.2719 | 0.3739 | 0.7370 | 2.52 | 0.2365 | Cf mt #1 |
| 138 | 34 | 10.87 | 54.76 | 2.72 | 2.86 | 0.2889 | 0.7926 | 0.6976 | 2.74 | 0.3028 | Cf mt #2 |
| 139 | 34 | 14.83 | 41.60 | 2.72 | 2.86 | 0.2889 | 0.7926 | 0.6976 | 2.74 | 0.3028 | Cf mt #2 |
| 140 | 34 | 10.76 | 81.27 | 2.72 | 2.86 | 0.2889 | 0.7926 | 0.6976 | 2.74 | 0.3028 | Cf mt #2 |
| 141 | 25 | 7.96 | 43.20 | 1.67 | 1.76 | 0.2979 | 0.3190 | 0.7595 | 2.38 | 0.1942 | age mt #3 |
| 142 | 46 | 11.11 | 77.04 | 2.43 | 2.55 | 0.3043 | 0.4819 | 0.7113 | 2.66 | 0.2808 | Cf mt #2 |
| 143 | 23 | 10.86 | 65.22 | 2.73 | 2.87 | 0.3072 | 0.6085 | 0.6867 | 2.79 | 0.3196 | Cf mt #1 |
| 144 | 23 | 10.27 | 70.68 | 2.73 | 2.87 | 0.3072 | 0.6085 | 0.6867 | 2.79 | 0.3196 | Cf mt #1 |
| 145 | 50 | 9.72 | 61.36 | 1.91 | 2.01 | 0.3073 | 0.2178 | 0.7343 | 2.54 | 0.2415 | Cf mt #2 |
| 146 | 50 | 9.36 | 62.52 | 1.91 | 2.01 | 0.3073 | 0.2178 | 0.7343 | 2.54 | 0.2415 | Cf mt #2 |
| 147 | 50 | 11.77 | 61.92 | 1.91 | 2.01 | 0.3073 | 0.2178 | 0.7343 | 2.54 | 0.2415 | Cf mt #2 |

| [1]Track No. | [2]Auto-scan No. | Confined length (μm) | Angle to C-axis (degrees) | [3]Meas. Dpar (μm) | [4]Corr. Dpar (μm) | [5]Meas. Cl (apfu) | [6]Calc. OH (apfu) | [7]$r_{mro}$ | [8]Calc. Dpar (μm) | [8]Calc. Cl (apfu) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 148 | 50 | 9.47 | 59.64 | 1.91 | 2.01 | 0.3073 | 0.2178 | 0.7343 | 2.54 | 0.2415 | Cf mt #2 |
| 149 | 5 | 11.77 | 59.98 | 2.58 | 2.71 | 0.3189 | 0.5439 | 0.7063 | 2.69 | 0.2890 | Cf mt #1 |
| 150 | 10 | 9.97 | 66.56 | 2.27 | 2.39 | 0.3331 | 0.7737 | 0.7220 | 2.61 | 0.2629 | age mt #2 |
| 151 | 3 | 11.45 | 66.93 | 2.77 | 2.91 | 0.3427 | 0.6995 | 0.6544 | 2.94 | 0.3662 | Cf mt #1 |
| 152 | 17 | 10.26 | 65.23 | 2.88 | 3.02 | 0.3564 | 0.7336 | 0.6128 | 3.12 | 0.4201 | Cf mt #2 |
| 153 | 25 | 10.19 | 56.80 | 2.29 | 2.40 | 0.3598 | 0.5640 | 0.7230 | 2.60 | 0.2611 | Cf mt #1 |
| 154 | 8 | 10.17 | 2.65 | 1.93 | 2.03 | 0.3622 | 0.3793 | 0.7439 | 2.48 | 0.2240 | Cf mt #1 |
| 155 | 54 | 10.48 | 57.28 | 2.77 | 2.91 | 0.3778 | 0.5652 | 0.6978 | 2.73 | 0.3024 | Cf mt #2 |
| 156 | 49 | 12.05 | 19.43 | 2.75 | 2.89 | 0.383 | 0.1976 | 0.7470 | 2.46 | 0.2181 | Cf mt #2 |
| 157 | 49 | 11.84 | 35.13 | 2.75 | 2.89 | 0.383 | 0.1976 | 0.7470 | 2.46 | 0.2181 | Cf mt #2 |
| 158 | 7 | 10.81 | 56.45 | 1.98 | 2.08 | 0.3935 | 0.5540 | 0.6909 | 2.77 | 0.3132 | age mt #2 |
| 159 | 7 | 11.04 | 52.46 | 1.98 | 2.08 | 0.3935 | 0.5540 | 0.6909 | 2.77 | 0.3132 | age mt #2 |
| 160 | 24 | 9.26 | 74.38 | 2.58 | 2.72 | 0.4226 | 0.5848 | 0.5872 | 3.22 | 0.4505 | Cf mt #2 |
| 161 | 4 | 10.81 | 84.82 | 2.45 | 2.57 | 0.4285 | 0.4284 | 0.5910 | 3.20 | 0.4461 | Cf mt #1 |
| 162 | 7 | 10.60 | 72.45 | 2.55 | 2.68 | 0.4657 | 0.0000 | 0.6552 | 2.94 | 0.3651 | Cf mt #1 |
| 163 | 7 | 11.30 | 82.95 | 2.55 | 2.68 | 0.4657 | 0.0000 | 0.6552 | 2.94 | 0.3651 | Cf mt #1 |
| 164 | 12 | 9.67 | 52.63 | 3.00 | 3.15 | 0.468 | 0.6348 | 0.6467 | 2.98 | 0.3767 | Cf mt #2 |
| 165 | 12 | 8.69 | 68.54 | 3.00 | 3.15 | 0.468 | 0.6348 | 0.6467 | 2.98 | 0.3767 | Cf mt #2 |
| 166 | 29 | 12.22 | 38.62 | 2.73 | 2.87 | 0.4862 | 0.8291 | 0.6209 | 3.09 | 0.4101 | age mt #3 |
| 167 | 51 | 11.01 | 85.75 | 2.38 | 2.50 | 0.5409 | 0.8196 | 0.6592 | 2.92 | 0.3595 | Cf mt #2 |
| 168 | 20 | 13.92 | 54.16 | 3.02 | 3.18 | 0.5877 | 0.7122 | 0.4670 | 3.61 | 0.5718 | age mt #3 |
| 169 | 20 | 12.48 | 8.05 | 3.02 | 3.18 | 0.5877 | 0.7122 | 0.4670 | 3.61 | 0.5718 | age mt #3 |
| 170 | 32 | 13.15 | 86.20 | 2.74 | 2.88 | 0.6267 | 0.8030 | 0.5128 | 3.47 | 0.5292 | age mt #3 |
| 171 | 32 | 12.96 | 35.55 | 2.74 | 2.88 | 0.6267 | 0.8030 | 0.5128 | 3.47 | 0.5292 | age mt #3 |
| | | **10.41** | | **2.25** | **2.36** | **0.256** | | | **2.61** | **0.265** | **mean** |
| | | **1.99** | | **0.39** | **0.41** | **0.113** | | | **0.31** | **0.094** | **stand. dev.** |
| 172 | 4 | 12.13 | 52.26 | 1.48 | 1.55 | - | - | - | - | - | age mt #2 |
| 173 | 3 | 10.79 | 59.74 | 1.84 | 1.94 | - | - | - | - | - | Cf mt #2 |
| 174 | 52 | 13.51 | 50.72 | 1.32 | 1.39 | - | - | - | - | - | Cf mt #2 |

[1]All track length measurements by A. Grist

[2]Autoscan number used for locating grains for microprobe measurements

[3]Average etch figure size parallel to c-axis measured by A. Grist (1.74 μm for Durango apatite)

[4]Corrected by reference to Carlson *et al*. (1999) Durango apatite Dpar value (1.83 μm)

[5]Measured Cl content from microprobe data of Table 3b

[6]OH concentration calculated using microprobe data (Table 3)

[7]Kinetic parameter calculated using full probe data (Table 3b) in equation 6 of Carlson *et al*. (1999)

[8]Calculated using $r_{mro}$ value and equations 4a,b of Ketcham *et al.* (2000)

**Table 3a. Elemental data (wt%) for East MacKay I-77 apatite fission track sample.**

| [1]Analysis No. | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | Total | [2]Autoscan No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Weight % | | | | | | | | |
| **f2cf002: Cf mount #1** | | | | | | | | | | | | | | | | |
| 8 | 34.263 | 1.961 | 0.071 | 0.090 | 17.274 | 0.126 | 0.564 | 37.313 | 0.095 | 0.203 | 0.000 | 0.000 | 0.241 | 0.757 | 92.96 | 1 |
| 20 | 32.865 | 3.253 | 0.018 | 0.058 | 18.179 | 0.000 | 0.161 | 38.474 | 0.061 | 0.224 | 0.000 | 0.000 | 0.000 | 0.157 | 93.45 | 2 |
| 16 | 33.490 | 1.598 | 0.074 | 0.077 | 16.718 | 0.502 | 1.062 | 36.021 | 0.127 | 0.219 | 0.000 | 0.000 | 0.000 | 0.208 | 90.09 | 3 |
| 17 | 32.757 | 1.911 | 0.118 | 0.081 | 17.300 | 0.214 | 1.335 | 36.825 | 0.247 | 0.257 | 0.000 | 0.000 | 0.107 | 0.513 | 91.66 | 4 |
| 18 | 34.624 | 1.981 | 0.219 | 0.050 | 17.652 | 0.929 | 1.039 | 37.912 | 0.104 | 0.145 | 0.000 | 0.000 | 0.145 | 0.419 | 95.22 | 5 |
| 19 | 33.547 | 2.151 | 0.125 | 0.037 | 17.547 | 0.566 | 0.664 | 37.429 | 0.125 | 0.146 | 0.000 | 0.000 | 0.144 | 0.527 | 93.01 | 6 |
| 21 | 35.355 | 2.995 | 0.049 | 0.140 | 17.563 | 0.438 | 1.553 | 37.575 | 0.116 | 0.271 | 0.040 | 0.000 | 0.157 | 0.453 | 96.70 | 7 |
| 13 | 35.453 | 2.231 | 0.000 | 0.014 | 17.843 | 0.000 | 1.194 | 38.490 | 0.100 | 0.076 | 0.000 | 0.000 | 0.000 | 0.234 | 95.63 | 8 |
| 14 | 32.834 | 2.258 | 0.152 | 0.040 | 17.254 | 0.351 | 0.849 | 36.915 | 0.108 | 0.130 | 0.000 | 0.000 | 0.092 | 0.438 | 91.42 | 9 |
| 15 | 37.294 | 2.410 | 0.001 | 0.110 | 18.008 | 0.000 | 0.246 | 38.448 | 0.075 | 0.341 | 0.000 | 0.000 | 0.011 | 0.202 | 97.14 | 10 |
| 12 | 35.119 | 2.904 | 0.026 | 0.033 | 17.701 | 0.000 | 0.111 | 37.580 | 0.064 | 0.251 | 0.000 | 0.000 | 0.035 | 0.297 | 94.12 | 11 |
| 7 | 35.990 | 2.110 | 0.000 | 0.000 | 17.931 | 0.000 | 0.285 | 38.400 | 0.040 | 0.033 | 0.000 | 0.000 | 0.010 | 0.253 | 95.05 | 12 |
| 9 | 35.516 | 2.919 | 0.147 | 0.025 | 17.316 | 0.365 | 0.739 | 36.874 | 0.160 | 0.140 | 0.000 | 0.000 | 0.304 | 0.976 | 95.48 | 13 |
| 10 | 35.025 | 2.767 | 0.002 | 0.043 | 18.116 | 0.000 | 0.037 | 38.609 | 0.059 | 0.168 | 0.000 | 0.000 | 0.000 | 0.120 | 94.95 | 14 |
| 34 | 30.049 | 2.814 | 0.038 | 0.032 | 17.569 | 0.013 | 0.202 | 36.198 | 0.058 | 0.137 | 0.000 | 0.000 | 0.011 | 0.136 | 87.26 | 15 |
| 26 | 34.274 | 3.656 | 0.150 | 0.138 | 17.181 | 1.138 | 0.500 | 37.029 | 0.082 | 0.199 | 0.000 | 0.000 | 0.136 | 0.540 | 95.02 | 16 |
| 25 | 34.438 | 3.067 | 0.009 | 0.202 | 18.037 | 0.000 | 0.320 | 37.516 | 0.043 | 0.310 | 0.000 | 0.000 | 0.000 | 0.235 | 94.18 | 17 |
| 33 | 34.811 | 1.900 | 0.017 | 0.127 | 18.266 | 0.039 | 0.274 | 37.777 | 0.063 | 0.258 | 0.000 | 0.000 | 0.000 | 0.173 | 93.70 | 18 |
| 29 | 32.977 | 2.179 | 0.000 | 0.000 | 18.250 | 0.000 | 0.539 | 38.436 | 0.060 | 0.026 | 0.000 | 0.000 | 0.032 | 0.164 | 92.66 | 19 |
| 27 | 36.638 | 1.914 | 0.022 | 0.117 | 17.913 | 0.000 | 0.731 | 38.027 | 0.072 | 0.247 | 0.000 | 0.000 | 0.085 | 0.320 | 96.08 | 20 |
| 32 | 34.369 | 2.659 | 0.054 | 0.000 | 17.848 | 0.449 | 0.578 | 38.058 | 0.115 | 0.061 | 0.000 | 0.000 | 0.230 | 0.426 | 94.85 | 21 |
| 28 | 36.471 | 2.801 | 0.059 | 0.000 | 17.761 | 0.653 | 0.132 | 38.372 | 0.046 | 0.043 | 0.000 | 0.000 | 0.128 | 0.307 | 96.77 | 22 |
| 30 | 35.392 | 1.912 | 0.129 | 0.051 | 17.790 | 0.680 | 1.010 | 37.873 | 0.119 | 0.199 | 0.023 | 0.000 | 0.094 | 0.509 | 95.78 | 23 |
| 31 | 34.708 | 3.449 | 0.047 | 0.019 | 17.883 | 0.090 | 0.143 | 37.886 | 0.040 | 0.236 | 0.000 | 0.000 | 0.091 | 0.440 | 95.03 | 24 |
| 22 | 34.167 | 1.852 | 0.003 | 0.007 | 18.125 | 0.000 | 1.157 | 38.345 | 0.083 | 0.108 | 0.000 | 0.000 | 0.000 | 0.148 | 94.00 | 25 |
| 11 | 33.074 | 3.707 | 0.042 | 0.001 | 17.461 | 0.000 | 0.047 | 37.511 | 0.179 | 0.098 | 0.000 | 0.000 | 0.192 | 0.549 | 92.86 | 26 |
| **f2cf02b: Cf mount #2** | | | | | | | | | | | | | | | | |
| 70 | 36.149 | 3.688 | 0.024 | 0.002 | 17.370 | 0.013 | 0.245 | 37.684 | 0.068 | 0.141 | 0.000 | 0.000 | 0.427 | 0.758 | 96.57 | 1 |
| 68 | 36.688 | 1.742 | 0.038 | 0.109 | 17.837 | 0.319 | 0.836 | 38.331 | 0.068 | 0.290 | 0.000 | 0.000 | 0.051 | 0.271 | 96.58 | 2 |
| 37 | 36.644 | 2.268 | 0.021 | 0.015 | 17.983 | 0.000 | 0.615 | 38.268 | 0.112 | 0.177 | 0.000 | 0.000 | 0.000 | 0.250 | 96.35 | 4 |
| 36 | 31.505 | 1.944 | 0.001 | 0.009 | 17.856 | 0.064 | 0.738 | 37.858 | 0.120 | 0.170 | 0.000 | 0.000 | 0.117 | 0.386 | 90.77 | 5 |
| 80 | 36.129 | 3.976 | 0.000 | 0.002 | 17.941 | 0.000 | 0.031 | 38.894 | 0.025 | 0.029 | 0.000 | 0.000 | 0.000 | 0.042 | 97.07 | 8 |
| 79 | 36.192 | 3.130 | 0.027 | 0.108 | 18.051 | 0.000 | 0.615 | 37.944 | 0.085 | 0.280 | 0.000 | 0.000 | 0.017 | 0.295 | 96.74 | 9 |
| 76 | 36.260 | 3.280 | 0.077 | 0.011 | 17.833 | 0.956 | 0.193 | 38.722 | 0.060 | 0.081 | 0.000 | 0.000 | 0.095 | 0.098 | 97.67 | 11 |
| 78 | 39.170 | 1.664 | 0.081 | 0.041 | 17.158 | 0.114 | 1.614 | 37.505 | 0.096 | 0.180 | 0.000 | 0.000 | 0.147 | 0.430 | 98.20 | 12 |
| 39 | 30.227 | 2.020 | 0.000 | 0.000 | 16.618 | 0.013 | 0.609 | 36.828 | 0.079 | 0.147 | 0.000 | 0.000 | 0.269 | 0.557 | 87.37 | 13 |
| 38 | 36.566 | 3.396 | 0.045 | 0.225 | 17.952 | 0.103 | 0.200 | 37.566 | 0.073 | 0.356 | 0.000 | 0.000 | 0.090 | 0.399 | 96.97 | 14 |
| 81 | 38.751 | 2.333 | 0.072 | 0.152 | 17.602 | 0.829 | 0.137 | 38.398 | 0.026 | 0.157 | 0.289 | 0.000 | 0.000 | 0.058 | 98.80 | 15 |
| 41 | 37.973 | 2.824 | 0.000 | 0.000 | 18.064 | 0.013 | 0.111 | 38.638 | 0.056 | 0.052 | 0.000 | 0.000 | 0.000 | 0.108 | 97.84 | 16 |
| 82 | 37.428 | 1.641 | 0.069 | 0.101 | 17.837 | 0.255 | 1.205 | 38.054 | 0.140 | 0.301 | 0.000 | 0.000 | 0.030 | 0.292 | 97.35 | 17 |
| 83 | 37.151 | 3.958 | 0.187 | 0.036 | 17.820 | 0.458 | 0.494 | 37.939 | 0.198 | 0.224 | 0.000 | 0.000 | 0.044 | 0.130 | 98.64 | 18 |
| 75 | 37.733 | 3.736 | 0.057 | 0.000 | 18.163 | 0.421 | 0.019 | 39.011 | 0.041 | 0.065 | 0.000 | 0.000 | 0.000 | 0.000 | 99.25 | 19 |
| 74 | 35.194 | 3.180 | 0.082 | 0.052 | 17.474 | 0.421 | 0.791 | 38.041 | 0.119 | 0.148 | 0.000 | 0.000 | 0.214 | 0.365 | 96.08 | 20 |
| 73 | 36.657 | 3.322 | 0.020 | 0.007 | 17.276 | 0.000 | 0.136 | 37.381 | 0.076 | 0.085 | 0.000 | 0.000 | 0.239 | 1.031 | 96.23 | 21 |
| 40 | 36.427 | 3.692 | 0.037 | 0.000 | 18.301 | 0.039 | 0.014 | 38.672 | 0.226 | 0.148 | 0.000 | 0.000 | 0.000 | 0.067 | 97.62 | 22 |
| 72 | 36.073 | 2.754 | 0.127 | 0.006 | 17.651 | 0.535 | 0.837 | 38.621 | 0.075 | 0.120 | 0.000 | 0.000 | 0.053 | 0.298 | 97.15 | 23 |
| 85 | 37.576 | 1.797 | 0.098 | 0.081 | 17.801 | 0.217 | 1.431 | 37.264 | 0.115 | 0.320 | 0.000 | 0.000 | 0.205 | 0.519 | 97.42 | 24 |
| 71 | 38.643 | 1.953 | 0.005 | 0.017 | 18.069 | 0.000 | 0.885 | 38.834 | 0.066 | 0.107 | 0.000 | 0.000 | 0.000 | 0.056 | 98.63 | 25 |
| 84 | 35.357 | 2.671 | 0.065 | 0.000 | 17.116 | 0.572 | 0.590 | 37.882 | 0.061 | 0.131 | 0.000 | 0.000 | 0.000 | 0.109 | 94.55 | 26 |
| 91 | 36.335 | 2.393 | 0.021 | 0.000 | 17.154 | 0.064 | 0.005 | 38.421 | 0.001 | 0.002 | 0.320 | 0.000 | 0.000 | 0.194 | 94.91 | 27 |
| 92 | 33.125 | 1.991 | 0.000 | 0.000 | 17.436 | 0.000 | 0.550 | 37.873 | 0.078 | 0.075 | 0.000 | 0.000 | 0.000 | 0.225 | 91.35 | 28 |
| 42 | 37.322 | 2.882 | 0.000 | 0.149 | 18.066 | 0.039 | 0.109 | 38.473 | 0.045 | 0.175 | 0.018 | 0.000 | 0.000 | 0.167 | 97.44 | 29 |
| 69 | 34.764 | 2.316 | 0.042 | 0.014 | 17.998 | 0.486 | 0.592 | 38.413 | 0.084 | 0.116 | 0.000 | 0.000 | 0.000 | 0.132 | 94.96 | 30 |
| 87 | 36.072 | 2.426 | 0.044 | 0.052 | 17.471 | 0.407 | 0.697 | 37.999 | 0.012 | 0.336 | 0.035 | 0.000 | 0.019 | 0.237 | 95.81 | 31 |
| 43 | 38.736 | 2.088 | 0.106 | 0.048 | 17.801 | 0.794 | 0.655 | 38.160 | 0.138 | 0.253 | 0.000 | 0.000 | 0.059 | 0.310 | 99.15 | 33 |
| 47 | 38.674 | 1.689 | 0.024 | 0.170 | 17.921 | 0.346 | 0.995 | 38.065 | 0.012 | 0.210 | 0.000 | 0.000 | 0.005 | 0.122 | 98.23 | 34 |
| 44 | 36.938 | 3.740 | 0.000 | 0.203 | 17.916 | 0.000 | 0.482 | 38.009 | 0.081 | 0.379 | 0.000 | 0.000 | 0.115 | 0.347 | 98.21 | 35 |
| 86 | 40.689 | 2.966 | 0.000 | 0.002 | 18.058 | 0.038 | 0.295 | 38.453 | 0.037 | 0.077 | 0.000 | 0.000 | 0.039 | 0.177 | 100.83 | 36 |
| 45 | 35.864 | 3.516 | 0.112 | 0.019 | 17.795 | 0.064 | 0.604 | 37.118 | 0.035 | 0.124 | 0.000 | 0.000 | 0.244 | 0.724 | 96.22 | 37 |
| 46 | 36.108 | 2.390 | 0.058 | 0.005 | 17.845 | 0.333 | 0.657 | 37.788 | 0.135 | 0.171 | 0.000 | 0.000 | 0.062 | 0.225 | 95.78 | 38 |
| 48 | 37.103 | 1.736 | 0.022 | 0.114 | 18.008 | 0.077 | 0.646 | 37.545 | 0.148 | 0.435 | 0.000 | 0.000 | 0.000 | 0.051 | 95.89 | 39 |
| 51 | 35.482 | 2.783 | 0.000 | 0.000 | 18.016 | 0.231 | 0.139 | 38.295 | 0.038 | 0.058 | 0.000 | 0.000 | 0.005 | 0.142 | 95.19 | 40 |
| 88 | 36.703 | 1.938 | 0.219 | 0.100 | 17.376 | 0.434 | 0.610 | 36.741 | 0.103 | 0.206 | 0.000 | 0.000 | 0.303 | 0.892 | 95.63 | 41 |

| [1]Analysis | | | | | | | Weight % | | | | | | | | | [2]Autoscan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | Total | No. |
| 50 | 36.160 | 2.400 | 0.001 | 0.014 | 18.118 | 0.090 | 0.239 | 38.580 | 0.035 | 0.120 | 0.000 | 0.000 | 0.000 | 0.070 | 95.83 | 42 |
| 49 | 36.527 | 3.279 | 0.002 | 0.000 | 18.283 | 0.090 | 0.028 | 38.870 | 0.000 | 0.035 | 0.000 | 0.000 | 0.000 | 0.000 | 97.11 | 43 |
| 66 | 36.344 | 2.697 | 0.064 | 0.029 | 18.035 | 0.051 | 0.253 | 38.590 | 0.144 | 0.204 | 0.000 | 0.000 | 0.017 | 0.260 | 96.69 | 44 |
| 89 | 36.294 | 3.604 | 0.143 | 0.013 | 17.662 | 0.089 | 0.335 | 37.446 | 0.085 | 0.097 | 0.000 | 0.000 | 0.331 | 0.918 | 97.02 | 45 |
| 67 | 37.082 | 2.192 | 0.105 | 0.039 | 17.671 | 0.153 | 1.027 | 37.903 | 0.088 | 0.182 | 0.000 | 0.000 | 0.233 | 0.562 | 97.24 | 46 |
| 52 | 36.380 | 2.241 | 0.000 | 0.000 | 18.044 | 0.000 | 0.265 | 38.588 | 0.025 | 0.014 | 0.000 | 0.000 | 0.000 | 0.056 | 95.61 | 47 |
| 53 | 36.925 | 2.758 | 0.097 | 0.034 | 17.720 | 0.371 | 0.660 | 38.088 | 0.089 | 0.119 | 0.000 | 0.000 | 0.170 | 0.441 | 97.47 | 48 |
| 54 | 36.352 | 2.574 | 0.276 | 0.016 | 17.401 | 1.403 | 1.293 | 37.351 | 0.095 | 0.046 | 0.000 | 0.000 | 0.192 | 0.458 | 97.46 | 49 |
| 65 | 36.120 | 2.651 | 0.133 | 0.035 | 17.647 | 0.510 | 1.030 | 37.792 | 0.111 | 0.160 | 0.000 | 0.000 | 0.063 | 0.389 | 96.64 | 50 |
| 64 | 37.415 | 1.151 | 0.003 | 0.002 | 17.949 | 0.026 | 1.816 | 37.994 | 0.082 | 0.076 | 0.000 | 0.000 | 0.000 | 0.092 | 96.61 | 51 |
| 55 | 34.877 | 3.667 | 0.055 | 0.125 | 17.734 | 0.282 | 0.563 | 37.773 | 0.042 | 0.316 | 0.000 | 0.000 | 0.095 | 0.269 | 95.80 | 53 |
| 61 | 34.261 | 1.811 | 0.081 | 0.051 | 17.939 | 0.295 | 1.212 | 37.355 | 0.047 | 0.150 | 0.000 | 0.000 | 0.155 | 0.436 | 93.79 | 54 |
| 63 | 35.868 | 3.216 | 0.004 | 0.007 | 17.897 | 0.013 | 0.038 | 38.508 | 0.013 | 0.122 | 0.000 | 0.000 | 0.000 | 0.086 | 95.77 | 55 |
| 62 | 35.580 | 3.847 | 0.014 | 0.000 | 17.036 | 0.115 | 0.048 | 37.443 | 0.035 | 0.058 | 0.000 | 0.000 | 0.133 | 0.556 | 94.86 | 56 |
| 60 | 34.777 | 2.766 | 0.038 | 0.000 | 17.698 | 0.000 | 0.847 | 37.798 | 0.041 | 0.049 | 0.000 | 0.000 | 0.043 | 0.251 | 94.31 | 57 |
| 90 | 34.945 | 2.346 | 0.096 | 0.038 | 17.866 | 0.243 | 0.643 | 37.618 | 0.222 | 0.108 | 0.000 | 0.000 | 0.066 | 0.401 | 94.59 | 58 |
| 58 | 37.407 | 3.112 | 0.016 | 0.000 | 18.283 | 0.000 | 0.021 | 38.753 | 0.056 | 0.124 | 0.000 | 0.000 | 0.000 | 0.000 | 97.77 | 59 |
| 57 | 36.970 | 2.415 | 0.043 | 0.016 | 18.135 | 0.128 | 0.602 | 38.345 | 0.082 | 0.227 | 0.000 | 0.000 | 0.000 | 0.153 | 97.11 | 60 |
| 59 | 37.614 | 1.918 | 0.045 | 0.000 | 18.082 | 0.000 | 0.585 | 38.010 | 0.151 | 0.059 | 0.000 | 0.000 | 0.013 | 0.201 | 96.68 | 61 |
| 56 | 34.919 | 2.312 | 0.000 | 0.004 | 18.141 | 0.000 | 0.534 | 38.356 | 0.049 | 0.060 | 0.000 | 0.000 | 0.000 | 0.087 | 94.46 | 62 |
| | | | | | | | **f0086011b: age mount #2** | | | | | | | | | |
| 107 | 40.753 | 1.642 | 0.004 | 0.053 | 17.881 | 0.023 | 0.286 | 40.008 | 0.030 | 0.268 | 0.000 | 0.000 | 0.000 | 0.186 | 101.14 | 1 |
| 105 | 39.208 | 2.142 | 0.065 | 0.081 | 17.581 | 0.075 | 0.390 | 39.120 | 0.058 | 0.326 | 0.000 | 0.017 | 0.111 | 0.504 | 99.68 | 3 |
| 102 | 40.300 | 1.891 | 0.000 | 0.008 | 18.324 | 0.075 | 0.433 | 39.845 | 0.055 | 0.194 | 0.000 | 0.000 | 0.008 | 0.082 | 101.22 | 5 |
| 101 | 41.385 | 1.655 | 0.030 | 0.000 | 18.354 | 0.060 | 0.551 | 39.497 | 0.138 | 0.078 | 0.000 | 0.142 | 0.004 | 0.293 | 102.19 | 6 |
| 100 | 38.024 | 1.924 | 0.117 | 0.021 | 17.570 | 0.247 | 1.347 | 38.217 | 0.138 | 0.134 | 0.000 | 0.023 | 0.210 | 0.387 | 98.36 | 7 |
| 104 | 40.134 | 2.832 | 0.000 | 0.000 | 17.478 | 0.000 | 0.055 | 39.406 | 0.027 | 0.177 | 0.000 | 0.264 | 0.069 | 0.631 | 101.07 | 8 |
| 103 | 38.460 | 2.458 | 0.012 | 0.000 | 18.260 | 0.045 | 0.232 | 39.617 | 0.043 | 0.114 | 0.000 | 0.023 | 0.041 | 0.236 | 99.54 | 9 |
| 108 | 41.457 | 1.729 | 0.179 | 0.018 | 17.308 | 0.351 | 1.203 | 39.379 | 0.027 | 0.097 | 0.063 | 0.000 | 0.001 | 0.337 | 102.15 | 10 |
| 99 | 40.671 | 1.768 | 0.000 | 0.000 | 18.094 | 0.083 | 0.640 | 39.208 | 0.044 | 0.162 | 0.000 | 0.050 | 0.397 | 0.593 | 101.71 | 11 |
| 98 | 39.134 | 3.125 | 0.040 | 0.002 | 17.787 | 0.427 | 0.139 | 39.382 | 0.060 | 0.137 | 0.000 | 0.023 | 0.158 | 0.384 | 100.80 | 12 |
| 106 | 42.047 | 0.473 | 0.111 | 0.222 | 16.666 | 0.277 | 0.687 | 38.657 | 0.062 | 0.364 | 0.332 | 0.000 | 0.000 | 0.181 | 100.08 | 13 |
| 97 | 39.309 | 2.268 | 0.011 | 0.004 | 18.542 | 0.098 | 0.144 | 39.832 | 0.123 | 0.090 | 0.000 | 0.000 | 0.053 | 0.098 | 100.57 | 14 |
| | | | | | | | **f0086011: age mount #1** | | | | | | | | | |
| 115 | 39.603 | 1.686 | 0.036 | 0.042 | 18.199 | 0.000 | 0.070 | 40.072 | 0.118 | 0.201 | 0.000 | 0.030 | 0.000 | 0.114 | 100.17 | 1 |
| 117 | 38.318 | 1.327 | 0.115 | 0.074 | 17.655 | 0.113 | 1.300 | 38.827 | 0.172 | 0.231 | 0.000 | 0.076 | 0.144 | 0.738 | 99.09 | 2 |
| 110 | 39.896 | 1.811 | 0.037 | 0.069 | 17.118 | 0.000 | 0.408 | 39.230 | 0.036 | 0.309 | 0.000 | 0.000 | 0.000 | 0.252 | 99.17 | 3 |
| 113 | 39.768 | 3.155 | 0.000 | 0.009 | 16.295 | 0.000 | 0.001 | 39.218 | 0.000 | 0.078 | 0.000 | 0.186 | 0.360 | 0.980 | 100.05 | 5 |
| 111 | 40.758 | 2.011 | 0.009 | 0.124 | 17.659 | 0.030 | 0.232 | 39.217 | 0.022 | 0.311 | 0.054 | 0.000 | 0.000 | 0.208 | 100.63 | 6 |
| 112 | 41.275 | 1.480 | 0.007 | 0.010 | 17.227 | 0.000 | 0.077 | 40.017 | 0.010 | 0.101 | 0.000 | 0.000 | 0.000 | 0.186 | 100.39 | 7 |
| 109 | 40.553 | 1.723 | 0.005 | 0.156 | 17.397 | 0.000 | 0.171 | 39.830 | 0.023 | 0.297 | 0.000 | 0.005 | 0.000 | 0.161 | 100.32 | 8 |
| 114 | 40.602 | 1.782 | 0.019 | 0.025 | 17.454 | 0.000 | 0.742 | 39.459 | 0.100 | 0.210 | 0.000 | 0.048 | 0.054 | 0.454 | 100.95 | 9 |
| 116 | 38.571 | 2.506 | 0.051 | 0.057 | 17.805 | 0.000 | 0.377 | 39.556 | 0.055 | 0.317 | 0.000 | 0.000 | 0.086 | 0.405 | 99.78 | 11 |
| 118 | 40.121 | 1.744 | 0.022 | 0.217 | 18.006 | 0.015 | 0.639 | 39.603 | 0.039 | 0.323 | 0.000 | 0.000 | 0.000 | 0.098 | 100.83 | 12 |
| 119 | 38.815 | 2.188 | 0.020 | 0.017 | 17.963 | 0.000 | 0.324 | 39.795 | 0.089 | 0.209 | 0.000 | 0.000 | 0.000 | 0.155 | 99.57 | 13 |
| | | | | | | | **f2098002: age mount #3** | | | | | | | | | |
| 143 | 40.621 | 3.708 | 0.044 | 0.002 | 17.974 | 0.212 | 0.019 | 39.328 | 0.033 | 0.182 | 0.028 | 0.000 | 0.000 | 0.111 | 102.26 | 1 |
| 142 | 40.010 | 3.682 | 0.023 | 0.000 | 18.141 | 0.053 | 0.093 | 39.253 | 0.099 | 0.086 | 0.000 | 0.278 | 0.000 | 0.000 | 101.72 | 2 |
| 473 | 35.538 | 2.258 | 0.047 | 0.240 | 17.557 | 0.019 | 0.446 | 37.156 | 0.060 | 0.200 | 0.475 | 0.000 | 0.028 | 0.256 | 94.28 | 3 |
| 154 | 41.098 | 3.210 | 0.077 | 0.209 | 17.849 | 0.064 | 0.421 | 38.389 | 0.064 | 0.276 | 0.068 | 0.001 | 0.148 | 0.534 | 102.41 | 4 |
| 153 | 40.251 | 3.190 | 0.064 | 0.063 | 18.134 | 0.075 | 0.353 | 39.085 | 0.072 | 0.288 | 0.058 | 0.000 | 0.023 | 0.282 | 101.94 | 5 |
| 152 | 39.359 | 3.941 | 0.093 | 0.011 | 18.021 | 0.064 | 0.111 | 38.711 | 0.137 | 0.098 | 0.000 | 0.145 | 0.144 | 0.564 | 101.40 | 6 |
| 149 | 39.841 | 2.977 | 0.073 | 0.052 | 17.831 | 0.000 | 0.297 | 38.484 | 0.074 | 0.229 | 0.000 | 0.129 | 0.084 | 0.468 | 100.54 | 7 |
| 151 | 38.355 | 3.507 | 0.003 | 0.000 | 17.704 | 0.000 | 0.020 | 38.803 | 0.013 | 0.093 | 0.000 | 0.143 | 0.076 | 0.259 | 98.98 | 8 |
| 156 | 41.087 | 1.948 | 0.012 | 0.152 | 18.221 | 0.096 | 0.433 | 38.876 | 0.061 | 0.365 | 0.000 | 0.000 | 0.017 | 0.114 | 101.38 | 10 |
| 157 | 39.952 | 1.620 | 0.013 | 0.005 | 17.883 | 0.053 | 0.366 | 39.246 | 0.067 | 0.083 | 0.000 | 0.000 | 0.063 | 0.153 | 99.50 | 11 |
| 158 | 35.789 | 2.120 | 0.029 | 0.020 | 16.934 | 0.000 | 0.767 | 38.003 | 0.102 | 0.262 | 0.000 | 0.047 | 0.073 | 0.486 | 94.63 | 12 |
| 144 | 40.419 | 2.268 | 0.024 | 0.008 | 18.352 | 0.075 | 0.192 | 39.269 | 0.057 | 0.067 | 0.000 | 0.000 | 0.000 | 0.037 | 100.77 | 13 |
| 137 | 39.636 | 2.358 | 0.068 | 0.045 | 18.129 | 0.000 | 0.809 | 38.343 | 0.099 | 0.193 | 0.058 | 0.009 | 0.125 | 0.437 | 100.31 | 15 |
| 138 | 41.434 | 1.828 | 0.235 | 0.071 | 17.722 | 1.043 | 0.356 | 38.290 | 0.103 | 0.262 | 0.000 | 0.000 | 0.000 | 0.271 | 101.61 | 16 |
| 136 | 38.710 | 2.458 | 0.024 | 0.153 | 18.277 | 0.000 | 0.468 | 38.461 | 0.053 | 0.370 | 0.000 | 0.000 | 0.015 | 0.169 | 99.16 | 17 |
| 135 | 40.715 | 2.464 | 0.028 | 0.023 | 18.425 | 0.000 | 0.675 | 38.807 | 0.092 | 0.248 | 0.000 | 0.000 | 0.000 | 0.224 | 101.70 | 18 |
| 133 | 39.605 | 3.646 | 0.012 | 0.004 | 17.860 | 0.140 | 0.013 | 38.930 | 0.093 | 0.086 | 0.000 | 0.284 | 0.000 | 0.063 | 100.73 | 19 |
| 132 | 30.712 | 1.097 | 0.078 | 0.096 | 16.405 | 0.000 | 1.720 | 35.952 | 0.097 | 0.249 | 0.125 | 0.000 | 0.141 | 0.397 | 87.07 | 20 |
| 165 | 36.899 | 2.433 | 0.204 | 0.029 | 11.992 | 0.000 | 0.559 | 26.143 | 0.093 | 0.295 | 0.000 | 0.000 | 0.002 | 0.231 | 78.88 | 22 |
| 166 | 39.236 | 2.652 | 0.038 | 0.050 | 18.117 | 0.000 | 0.515 | 38.451 | 0.038 | 0.192 | 0.000 | 0.027 | 0.000 | 0.272 | 99.59 | 23 |

| [1]Analysis | | | | | | | | Weight % | | | | | | | | [2]Autoscan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | Total | No. |
| 167 | 40.160 | 3.869 | 0.009 | 0.158 | 18.334 | 0.000 | 0.117 | 38.359 | 0.046 | 0.276 | 0.111 | 0.000 | 0.005 | 0.164 | 101.61 | 24 |
| 168 | 42.097 | 2.713 | 0.090 | 0.000 | 17.915 | 0.000 | 1.090 | 37.819 | 0.094 | 0.091 | 0.000 | 0.000 | 0.120 | 0.440 | 102.47 | 25 |
| 163 | 40.962 | 2.946 | 0.036 | 0.000 | 18.184 | 0.000 | 0.153 | 38.769 | 0.065 | 0.072 | 0.000 | 0.000 | 0.000 | 0.285 | 101.47 | 26 |
| 164 | 40.117 | 2.014 | 0.090 | 0.171 | 17.967 | 0.043 | 1.194 | 38.212 | 0.107 | 0.246 | 0.039 | 0.042 | 0.000 | 0.090 | 100.33 | 27 |
| 169 | 42.466 | 1.347 | 0.012 | 0.027 | 18.038 | 0.000 | 1.773 | 38.347 | 0.115 | 0.197 | 0.013 | 0.000 | 0.051 | 0.285 | 102.67 | 29 |
| 170 | 41.171 | 1.098 | 0.049 | 0.020 | 18.207 | 0.095 | 2.245 | 38.219 | 0.114 | 0.240 | 0.000 | 0.000 | 0.000 | 0.156 | 101.61 | 32 |
| 474 | 36.379 | 1.889 | 0.083 | 0.065 | 17.346 | 0.036 | 0.836 | 37.213 | 0.104 | 0.215 | 0.068 | 0.000 | 0.162 | 0.615 | 95.01 | 33 |
| 159 | 40.732 | 4.723 | 0.006 | 0.031 | 17.998 | 0.085 | 0.059 | 39.591 | 0.005 | 0.275 | 0.066 | 0.000 | 0.000 | 0.003 | 103.57 | 34 |
| 162 | 41.684 | 3.172 | 0.059 | 0.003 | 18.046 | 0.287 | 0.102 | 39.083 | 0.009 | 0.123 | 0.022 | 0.000 | 0.000 | 0.100 | 102.69 | 35 |
| 161 | 41.797 | 2.452 | 0.191 | 0.051 | 17.523 | 0.213 | 0.494 | 38.026 | 0.155 | 0.106 | 0.070 | 0.009 | 0.305 | 0.969 | 102.36 | 37 |
| 160 | 41.081 | 2.914 | 0.035 | 0.000 | 18.111 | 0.000 | 0.169 | 39.175 | 0.035 | 0.087 | 0.000 | 0.000 | 0.041 | 0.219 | 101.87 | 39 |
| 146 | 40.450 | 3.248 | 0.070 | 0.218 | 18.153 | 0.085 | 0.416 | 38.787 | 0.033 | 0.245 | 0.067 | 0.000 | 0.093 | 0.408 | 102.27 | 40 |
| 150 | 39.683 | 3.297 | 0.055 | 0.005 | 17.731 | 0.468 | 0.271 | 38.920 | 0.007 | 0.088 | 0.140 | 0.000 | 0.000 | 0.116 | 100.78 | 43 |
| 148 | 41.149 | 3.628 | 0.145 | 0.177 | 18.116 | 0.085 | 0.468 | 38.312 | 0.063 | 0.230 | 0.090 | 0.000 | 0.190 | 0.713 | 103.36 | 44 |
| 155 | 40.044 | 2.530 | 0.024 | 0.004 | 17.810 | 0.074 | 0.548 | 38.561 | 0.072 | 0.093 | 0.048 | 0.000 | 0.040 | 0.253 | 100.10 | 48 |
| 134 | 39.650 | 1.672 | 0.000 | 0.003 | 18.109 | 0.000 | 0.918 | 39.115 | 0.086 | 0.152 | 0.000 | 0.000 | 0.034 | 0.187 | 99.93 | 49 |
| 145 | 39.265 | 1.862 | 0.146 | 0.051 | 18.138 | 0.394 | 0.309 | 38.780 | 0.107 | 0.258 | 0.039 | 0.000 | 0.009 | 0.169 | 99.53 | 50 |

[1]Number gives order in which apatite grains were probed; all microprobe analyses by A. Grist

[2]Number used to locate apatite grains on age and length mounts

**Table 3b. Elemental data (apfu) for East MacKay I-77 apatite fission track sample.**

| [1]Anal. No. | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | [a]OH | [3]Auto-Scan No. | Total Ca site (10) | Total P site (6) | Total F+Cl+OH (2) | wt% totals | [4]$r_{mro}$ | [5]calc. Dpar (μm) | [5]calc. Cl (apfu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | [2]Atoms per formula unit | | | | | | | | | | | | | | | | |
| | | | | | | | | | | **f2cf002: Cf mount #1** | | | | | | | | | | | | | |
| 8 | 23.155 | 1.150 | 0.034 | 0.041 | 6.215 | 0.044 | 0.177 | 10.375 | 0.019 | 0.041 | 0.000 | 0.000 | 0.019 | 0.060 | 0.668 | 1 | 10.59 | 6.26 | 2.00 | 92.96 | 0.7189 | 2.62 | 0.268 |
| 20 | 22.733 | 1.900 | 0.009 | 0.026 | 6.511 | 0.000 | 0.050 | 10.650 | 0.012 | 0.044 | 0.000 | 0.000 | 0.000 | 0.012 | 0.052 | 2 | 10.75 | 6.51 | 2.00 | 93.45 | 0.7952 | 2.13 | 0.118 |
| 16 | 23.201 | 0.962 | 0.037 | 0.036 | 6.174 | 0.179 | 0.343 | 10.281 | 0.026 | 0.045 | 0.000 | 0.000 | 0.000 | 0.017 | 0.699 | 3 | 10.44 | 6.35 | 2.00 | 90.09 | 0.6544 | 2.94 | 0.366 |
| 17 | 22.853 | 1.145 | 0.058 | 0.038 | 6.359 | 0.076 | 0.429 | 10.461 | 0.051 | 0.052 | 0.000 | 0.000 | 0.009 | 0.042 | 0.428 | 4 | 10.71 | 6.43 | 2.00 | 91.66 | 0.5910 | 3.20 | 0.446 |
| 18 | 22.972 | 1.135 | 0.104 | 0.022 | 6.202 | 0.315 | 0.319 | 10.294 | 0.021 | 0.028 | 0.000 | 0.000 | 0.011 | 0.033 | 0.544 | 5 | 10.51 | 6.52 | 2.00 | 95.22 | 0.7063 | 2.69 | 0.289 |
| 19 | 22.860 | 1.264 | 0.061 | 0.017 | 6.327 | 0.197 | 0.209 | 10.431 | 0.025 | 0.029 | 0.000 | 0.000 | 0.012 | 0.042 | 0.525 | 6 | 10.62 | 6.52 | 2.00 | 93.01 | 0.7376 | 2.52 | 0.235 |
| 21 | 23.502 | 1.677 | 0.023 | 0.061 | 6.030 | 0.145 | 0.466 | 9.971 | 0.022 | 0.052 | 0.005 | 0.000 | 0.012 | 0.034 | 0.000 | 7 | 10.18 | 6.18 | 2.14 | 96.70 | 0.6552 | 2.94 | 0.365 |
| 13 | 23.420 | 1.262 | 0.000 | 0.006 | 6.193 | 0.000 | 0.362 | 10.325 | 0.020 | 0.015 | 0.000 | 0.000 | 0.000 | 0.018 | 0.379 | 8 | 10.38 | 6.19 | 2.00 | 95.63 | 0.7439 | 2.48 | 0.224 |
| 14 | 22.908 | 1.350 | 0.075 | 0.019 | 6.326 | 0.124 | 0.272 | 10.460 | 0.022 | 0.026 | 0.000 | 0.000 | 0.008 | 0.035 | 0.374 | 9 | 10.65 | 6.45 | 2.00 | 91.42 | 0.7370 | 2.52 | 0.236 |
| 15 | 23.740 | 1.327 | 0.000 | 0.047 | 6.081 | 0.000 | 0.073 | 10.035 | 0.014 | 0.064 | 0.000 | 0.000 | 0.001 | 0.015 | 0.603 | 10 | 10.18 | 6.08 | 2.00 | 97.14 | 0.7244 | 2.59 | 0.259 |
| 12 | 23.503 | 1.659 | 0.012 | 0.015 | 6.204 | 0.000 | 0.034 | 10.179 | 0.013 | 0.049 | 0.000 | 0.000 | 0.003 | 0.023 | 0.306 | 11 | 10.29 | 6.20 | 2.00 | 94.12 | 0.7782 | 2.26 | 0.156 |
| 7 | 23.437 | 1.195 | 0.000 | 0.000 | 6.227 | 0.000 | 0.087 | 10.306 | 0.008 | 0.006 | 0.000 | 0.000 | 0.001 | 0.019 | 0.715 | 12 | 10.34 | 6.23 | 2.00 | 95.05 | 0.8066 | 2.04 | 0.091 |
| 9 | 23.741 | 1.652 | 0.069 | 0.011 | 6.011 | 0.122 | 0.224 | 9.893 | 0.031 | 0.027 | 0.000 | 0.000 | 0.024 | 0.075 | 0.120 | 13 | 10.13 | 6.13 | 2.00 | 95.48 | 0.7560 | 2.40 | 0.201 |
| 10 | 23.207 | 1.573 | 0.001 | 0.019 | 6.317 | 0.000 | 0.011 | 10.405 | 0.012 | 0.033 | 0.000 | 0.000 | 0.000 | 0.009 | 0.413 | 14 | 10.48 | 6.32 | 2.00 | 94.95 | 0.8018 | 2.08 | 0.102 |
| 34 | 22.312 | 1.773 | 0.020 | 0.016 | 6.788 | 0.005 | 0.068 | 10.809 | 0.013 | 0.029 | 0.000 | 0.000 | 0.001 | 0.012 | 0.155 | 15 | 10.90 | 6.79 | 2.00 | 87.26 | 0.8055 | 2.05 | 0.093 |
| 26 | 23.159 | 2.081 | 0.071 | 0.062 | 5.997 | 0.384 | 0.152 | 9.989 | 0.016 | 0.039 | 0.000 | 0.000 | 0.011 | 0.042 | 0.000 | 16 | 10.23 | 6.38 | 2.23 | 95.02 | 0.7710 | 2.31 | 0.171 |
| 25 | 23.288 | 1.758 | 0.004 | 0.090 | 6.341 | 0.000 | 0.098 | 10.193 | 0.009 | 0.060 | 0.000 | 0.000 | 0.000 | 0.018 | 0.141 | 17 | 10.37 | 6.34 | 2.00 | 94.18 | 0.7529 | 2.42 | 0.207 |
| 33 | 23.017 | 1.098 | 0.008 | 0.057 | 6.475 | 0.013 | 0.085 | 10.349 | 0.013 | 0.051 | 0.000 | 0.000 | 0.000 | 0.014 | 0.820 | 18 | 10.49 | 6.49 | 2.00 | 93.70 | 0.7282 | 2.57 | 0.252 |
| 29 | 22.576 | 1.288 | 0.000 | 0.000 | 6.618 | 0.000 | 0.171 | 10.772 | 0.012 | 0.005 | 0.000 | 0.000 | 0.003 | 0.013 | 0.542 | 19 | 10.81 | 6.62 | 2.00 | 92.66 | 0.7978 | 2.11 | 0.112 |
| 27 | 23.600 | 1.072 | 0.010 | 0.051 | 6.151 | 0.000 | 0.219 | 10.092 | 0.014 | 0.047 | 0.000 | 0.000 | 0.007 | 0.024 | 0.713 | 20 | 10.25 | 6.15 | 2.00 | 96.08 | 0.7010 | 2.72 | 0.297 |
| 32 | 23.104 | 1.526 | 0.026 | 0.000 | 6.282 | 0.153 | 0.178 | 10.352 | 0.023 | 0.012 | 0.000 | 0.000 | 0.018 | 0.033 | 0.295 | 21 | 10.46 | 6.43 | 2.00 | 94.85 | 0.7907 | 2.17 | 0.128 |
| 28 | 23.580 | 1.553 | 0.027 | 0.000 | 6.041 | 0.215 | 0.039 | 10.086 | 0.009 | 0.008 | 0.000 | 0.000 | 0.010 | 0.023 | 0.409 | 22 | 10.16 | 6.26 | 2.00 | 96.77 | 0.8260 | 1.88 | 0.041 |
| 30 | 23.199 | 1.085 | 0.060 | 0.023 | 6.191 | 0.229 | 0.307 | 10.187 | 0.023 | 0.038 | 0.003 | 0.000 | 0.007 | 0.039 | 0.608 | 23 | 10.38 | 6.42 | 2.00 | 95.78 | 0.6867 | 2.79 | 0.320 |
| 31 | 23.410 | 1.959 | 0.022 | 0.008 | 6.231 | 0.030 | 0.044 | 10.201 | 0.008 | 0.046 | 0.000 | 0.000 | 0.007 | 0.034 | 0.000 | 24 | 10.33 | 6.26 | 2.00 | 95.03 | 0.7985 | 2.11 | 0.110 |
| 22 | 22.946 | 1.075 | 0.001 | 0.003 | 6.452 | 0.000 | 0.360 | 10.549 | 0.017 | 0.021 | 0.000 | 0.000 | 0.000 | 0.012 | 0.564 | 25 | 10.60 | 6.45 | 2.00 | 94.00 | 0.7230 | 2.60 | 0.261 |
| 11 | 22.996 | 2.171 | 0.020 | 0.001 | 6.271 | 0.000 | 0.015 | 10.412 | 0.036 | 0.020 | 0.000 | 0.000 | 0.015 | 0.044 | 0.000 | 26 | 10.55 | 6.27 | 2.19 | 92.86 | 0.8229 | 1.91 | 0.049 |
| | | | | | | | | | | **f2cf02b: Cf mount #2** | | | | | | | | | | | | | |
| 70 | 23.871 | 2.051 | 0.011 | 0.001 | 5.925 | 0.004 | 0.073 | 9.934 | 0.013 | 0.027 | 0.000 | 0.000 | 0.032 | 0.057 | 0.000 | 1 | 10.08 | 5.93 | 2.12 | 96.57 | 0.8119 | 2 | 0.077 |
| 68 | 23.493 | 0.972 | 0.018 | 0.047 | 6.107 | 0.106 | 0.250 | 10.142 | 0.013 | 0.055 | 0.000 | 0.000 | 0.004 | 0.020 | 0.773 | 2 | 10.30 | 6.21 | 2.00 | 96.58 | 0.6700 | 2.87 | 0.344 |
| 37 | 23.656 | 1.263 | 0.010 | 0.007 | 6.146 | 0.000 | 0.184 | 10.107 | 0.022 | 0.034 | 0.000 | 0.000 | 0.000 | 0.019 | 0.554 | 4 | 10.20 | 6.15 | 2.00 | 96.35 | 0.7462 | 2.47 | 0.220 |
| 36 | 22.228 | 1.187 | 0.001 | 0.004 | 6.686 | 0.023 | 0.241 | 10.955 | 0.025 | 0.035 | 0.000 | 0.000 | 0.010 | 0.032 | 0.573 | 5 | 11.06 | 6.71 | 2.00 | 90.77 | 0.7228 | 2.6 | 0.261 |
| 80 | 23.597 | 2.187 | 0.000 | 0.001 | 6.053 | 0.000 | 0.009 | 10.141 | 0.005 | 0.005 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 8 | 10.15 | 6.05 | 2.20 | 97.07 | 0.8577 | 1.57 | -0.055 |
| 79 | 23.740 | 1.735 | 0.013 | 0.047 | 6.138 | 0.000 | 0.183 | 9.972 | 0.016 | 0.053 | 0.000 | 0.000 | 0.001 | 0.022 | 0.081 | 9 | 10.12 | 6.14 | 2.00 | 96.74 | 0.7452 | 2.47 | 0.222 |
| 76 | 23.510 | 1.803 | 0.035 | 0.005 | 6.011 | 0.311 | 0.057 | 10.087 | 0.011 | 0.015 | 0.000 | 0.000 | 0.007 | 0.007 | 0.141 | 11 | 10.17 | 6.32 | 2.00 | 97.66 | 0.8261 | 1.88 | 0.040 |
| 78 | 24.496 | 0.900 | 0.036 | 0.018 | 5.695 | 0.037 | 0.468 | 9.621 | 0.018 | 0.033 | 0.000 | 0.000 | 0.011 | 0.032 | 0.635 | 12 | 9.77 | 5.73 | 2.00 | 98.20 | 0.6467 | 2.98 | 0.377 |
| 39 | 22.284 | 1.285 | 0.000 | 0.000 | 6.483 | 0.005 | 0.207 | 11.104 | 0.017 | 0.032 | 0.000 | 0.000 | 0.023 | 0.048 | 0.512 | 13 | 11.22 | 6.49 | 2.00 | 87.37 | 0.7450 | 2.47 | 0.222 |
| 38 | 23.853 | 1.871 | 0.021 | 0.097 | 6.067 | 0.034 | 0.059 | 9.813 | 0.014 | 0.067 | 0.000 | 0.000 | 0.007 | 0.030 | 0.068 | 14 | 10.05 | 6.10 | 2.00 | 96.97 | 0.7509 | 2.44 | 0.211 |
| 81 | 23.986 | 1.254 | 0.032 | 0.064 | 5.803 | 0.264 | 0.040 | 9.784 | 0.005 | 0.029 | 0.034 | 0.000 | 0.000 | 0.004 | 0.703 | 15 | 9.95 | 6.07 | 2.00 | 98.80 | 0.7811 | 2.24 | 0.149 |
| 41 | 24.011 | 1.533 | 0.000 | 0.000 | 6.014 | 0.004 | 0.032 | 9.942 | 0.010 | 0.010 | 0.000 | 0.000 | 0.000 | 0.008 | 0.437 | 16 | 9.97 | 6.02 | 2.00 | 97.84 | 0.8267 | 1.88 | 0.039 |
| 82 | 23.747 | 0.906 | 0.031 | 0.044 | 6.038 | 0.083 | 0.356 | 9.955 | 0.027 | 0.056 | 0.000 | 0.000 | 0.002 | 0.022 | 0.734 | 17 | 10.14 | 6.12 | 2.00 | 97.35 | 0.6128 | 3.12 | 0.420 |

| [1]Anal. No. | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | [a]OH | [3]Auto-Scan No. | Total Ca site (10) | Total P site (6) | Total F+Cl+OH (2) | wt% totals | [4]$r_{mro}$ | [5]calc. Dpar (μm) | [5]calc. Cl (apfu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | [2]Atoms per formula unit | | | | | | | | | | | | | | | | |
| 83 | 23.792 | 2.135 | 0.083 | 0.015 | 5.895 | 0.146 | 0.143 | 9.699 | 0.037 | 0.041 | 0.000 | 0.000 | 0.003 | 0.010 | 0.000 | 18 | 9.89 | 6.04 | 2.28 | 98.64 | 0.7639 | 2.35 | 0.185 |
| 75 | 23.967 | 1.998 | 0.025 | 0.000 | 5.959 | 0.133 | 0.005 | 9.892 | 0.008 | 0.012 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 19 | 9.94 | 6.09 | 2.00 | 99.25 | 0.8490 | 1.66 | -0.027 |
| 74 | 23.506 | 1.788 | 0.038 | 0.023 | 6.028 | 0.140 | 0.238 | 10.143 | 0.023 | 0.028 | 0.000 | 0.000 | 0.016 | 0.028 | 0.000 | 20 | 10.30 | 6.17 | 2.03 | 96.08 | 0.7683 | 2.32 | 0.176 |
| 73 | 24.103 | 1.848 | 0.009 | 0.003 | 5.897 | 0.000 | 0.040 | 9.861 | 0.015 | 0.016 | 0.000 | 0.000 | 0.018 | 0.078 | 0.112 | 21 | 10.00 | 5.90 | 2.00 | 96.23 | 0.8246 | 1.89 | 0.044 |
| 40 | 23.685 | 2.021 | 0.017 | 0.000 | 6.147 | 0.012 | 0.004 | 10.038 | 0.043 | 0.028 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 22 | 10.13 | 6.16 | 2.03 | 97.62 | 0.8159 | 1.97 | 0.067 |
| 72 | 23.533 | 1.528 | 0.058 | 0.003 | 6.008 | 0.176 | 0.249 | 10.159 | 0.014 | 0.023 | 0.000 | 0.000 | 0.004 | 0.022 | 0.223 | 23 | 10.28 | 6.18 | 2.00 | 97.15 | 0.7671 | 2.33 | 0.179 |
| 85 | 23.966 | 0.990 | 0.044 | 0.035 | 6.017 | 0.071 | 0.423 | 9.734 | 0.022 | 0.060 | 0.000 | 0.000 | 0.015 | 0.039 | 0.585 | 24 | 9.95 | 6.09 | 2.00 | 97.42 | 0.5872 | 3.22 | 0.450 |
| 71 | 24.038 | 1.054 | 0.002 | 0.007 | 5.983 | 0.000 | 0.256 | 9.937 | 0.012 | 0.020 | 0.000 | 0.000 | 0.000 | 0.004 | 0.687 | 25 | 9.98 | 5.98 | 2.00 | 98.63 | 0.7488 | 2.45 | 0.215 |
| 84 | 23.555 | 1.519 | 0.031 | 0.000 | 5.969 | 0.193 | 0.180 | 10.210 | 0.012 | 0.025 | 0.000 | 0.000 | 0.000 | 0.008 | 0.299 | 26 | 10.29 | 6.16 | 2.00 | 94.55 | 0.7801 | 2.24 | 0.152 |
| 91 | 23.687 | 1.352 | 0.010 | 0.000 | 5.943 | 0.021 | 0.002 | 10.288 | 0.000 | 0.000 | 0.039 | 0.000 | 0.000 | 0.015 | 0.644 | 27 | 10.35 | 5.96 | 2.00 | 94.91 | 0.8346 | 1.8 | 0.016 |
| 92 | 22.831 | 1.190 | 0.000 | 0.000 | 6.391 | 0.000 | 0.176 | 10.728 | 0.016 | 0.015 | 0.000 | 0.000 | 0.000 | 0.018 | 0.634 | 28 | 10.78 | 6.39 | 2.00 | 91.35 | 0.7754 | 2.28 | 0.162 |
| 42 | 23.830 | 1.577 | 0.000 | 0.064 | 6.062 | 0.012 | 0.032 | 9.977 | 0.008 | 0.032 | 0.002 | 0.000 | 0.000 | 0.012 | 0.391 | 29 | 10.10 | 6.07 | 2.00 | 97.44 | 0.7967 | 2.12 | 0.114 |
| 69 | 23.058 | 1.323 | 0.020 | 0.006 | 6.306 | 0.164 | 0.181 | 10.401 | 0.017 | 0.023 | 0.000 | 0.000 | 0.000 | 0.010 | 0.491 | 30 | 10.48 | 6.47 | 2.00 | 94.96 | 0.7703 | 2.31 | 0.172 |
| 87 | 23.600 | 1.362 | 0.020 | 0.023 | 6.018 | 0.135 | 0.210 | 10.115 | 0.002 | 0.064 | 0.004 | 0.000 | 0.001 | 0.018 | 0.427 | 31 | 10.25 | 6.15 | 2.00 | 95.81 | 0.7041 | 2.7 | 0.292 |
| 43 | 23.989 | 1.122 | 0.047 | 0.020 | 5.869 | 0.253 | 0.189 | 9.722 | 0.026 | 0.046 | 0.000 | 0.000 | 0.004 | 0.023 | 0.690 | 33 | 9.89 | 6.12 | 2.00 | 99.15 | 0.7049 | 2.7 | 0.291 |
| 47 | 24.032 | 0.915 | 0.011 | 0.072 | 5.954 | 0.111 | 0.289 | 9.774 | 0.002 | 0.039 | 0.000 | 0.000 | 0.000 | 0.009 | 0.793 | 34 | 9.91 | 6.07 | 2.00 | 98.23 | 0.6976 | 2.74 | 0.303 |
| 44 | 23.849 | 2.033 | 0.000 | 0.086 | 5.975 | 0.000 | 0.140 | 9.797 | 0.015 | 0.070 | 0.000 | 0.000 | 0.009 | 0.026 | 0.000 | 35 | 10.00 | 5.97 | 2.17 | 98.21 | 0.7304 | 2.56 | 0.248 |
| 86 | 24.716 | 1.542 | 0.000 | 0.001 | 5.758 | 0.012 | 0.082 | 9.476 | 0.007 | 0.014 | 0.000 | 0.000 | 0.003 | 0.012 | 0.377 | 36 | 9.51 | 5.77 | 2.00 | 100.83 | 0.8163 | 1.97 | 0.066 |
| 45 | 23.764 | 1.962 | 0.052 | 0.008 | 6.091 | 0.021 | 0.181 | 9.819 | 0.007 | 0.024 | 0.000 | 0.000 | 0.019 | 0.055 | 0.000 | 37 | 9.98 | 6.11 | 2.14 | 96.22 | 0.7945 | 2.14 | 0.119 |
| 46 | 23.583 | 1.342 | 0.027 | 0.002 | 6.144 | 0.111 | 0.198 | 10.055 | 0.026 | 0.033 | 0.000 | 0.000 | 0.005 | 0.017 | 0.458 | 38 | 10.17 | 6.26 | 2.00 | 95.77 | 0.7463 | 2.46 | 0.219 |
| 48 | 23.703 | 0.969 | 0.010 | 0.050 | 6.165 | 0.025 | 0.193 | 9.934 | 0.029 | 0.083 | 0.000 | 0.000 | 0.000 | 0.004 | 0.835 | 39 | 10.11 | 6.19 | 2.00 | 95.89 | 0.6050 | 3.15 | 0.430 |
| 51 | 23.394 | 1.573 | 0.000 | 0.000 | 6.243 | 0.077 | 0.042 | 10.256 | 0.007 | 0.011 | 0.000 | 0.000 | 0.000 | 0.011 | 0.385 | 40 | 10.29 | 6.32 | 2.00 | 95.19 | 0.8266 | 1.88 | 0.039 |
| 88 | 23.760 | 1.091 | 0.102 | 0.044 | 5.998 | 0.145 | 0.184 | 9.802 | 0.020 | 0.039 | 0.000 | 0.000 | 0.023 | 0.068 | 0.723 | 41 | 10.10 | 6.14 | 2.00 | 95.63 | 0.7060 | 2.69 | 0.290 |
| 50 | 23.449 | 1.345 | 0.001 | 0.006 | 6.229 | 0.030 | 0.072 | 10.251 | 0.007 | 0.023 | 0.000 | 0.000 | 0.000 | 0.005 | 0.582 | 42 | 10.29 | 6.26 | 2.00 | 95.83 | 0.7964 | 2.12 | 0.115 |
| 49 | 23.663 | 1.804 | 0.001 | 0.000 | 6.169 | 0.029 | 0.008 | 10.136 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.184 | 43 | 10.14 | 6.20 | 2.00 | 97.11 | 0.8509 | 1.64 | -0.033 |
| 66 | 23.540 | 1.499 | 0.029 | 0.013 | 6.149 | 0.017 | 0.075 | 10.168 | 0.028 | 0.039 | 0.000 | 0.000 | 0.001 | 0.020 | 0.422 | 44 | 10.30 | 6.17 | 2.00 | 96.69 | 0.7678 | 2.33 | 0.177 |
| 89 | 23.855 | 1.995 | 0.065 | 0.006 | 5.996 | 0.029 | 0.099 | 9.825 | 0.016 | 0.018 | 0.000 | 0.000 | 0.025 | 0.069 | 0.000 | 45 | 10.03 | 6.03 | 2.09 | 97.02 | 0.8113 | 2.01 | 0.079 |
| 67 | 23.842 | 1.212 | 0.048 | 0.017 | 5.995 | 0.050 | 0.304 | 9.938 | 0.017 | 0.034 | 0.000 | 0.000 | 0.018 | 0.042 | 0.482 | 46 | 10.11 | 6.05 | 2.00 | 97.24 | 0.7113 | 2.66 | 0.281 |
| 52 | 23.521 | 1.257 | 0.000 | 0.000 | 6.207 | 0.000 | 0.080 | 10.259 | 0.005 | 0.003 | 0.000 | 0.000 | 0.000 | 0.004 | 0.664 | 47 | 10.27 | 6.21 | 2.00 | 95.61 | 0.8176 | 1.95 | 0.063 |
| 53 | 23.819 | 1.518 | 0.044 | 0.015 | 5.981 | 0.121 | 0.195 | 9.935 | 0.017 | 0.022 | 0.000 | 0.000 | 0.013 | 0.033 | 0.289 | 48 | 10.08 | 6.10 | 2.00 | 97.47 | 0.7737 | 2.29 | 0.165 |
| 54 | 23.645 | 1.422 | 0.126 | 0.007 | 5.899 | 0.459 | 0.383 | 9.785 | 0.018 | 0.009 | 0.000 | 0.000 | 0.014 | 0.034 | 0.198 | 49 | 9.99 | 6.36 | 2.00 | 97.46 | 0.7470 | 2.46 | 0.218 |
| 65 | 23.659 | 1.477 | 0.061 | 0.015 | 6.029 | 0.168 | 0.307 | 9.979 | 0.021 | 0.030 | 0.000 | 0.000 | 0.005 | 0.029 | 0.218 | 50 | 10.14 | 6.20 | 2.00 | 96.64 | 0.7343 | 2.54 | 0.241 |
| 64 | 23.823 | 0.640 | 0.001 | 0.001 | 6.119 | 0.008 | 0.541 | 10.011 | 0.016 | 0.014 | 0.000 | 0.000 | 0.000 | 0.007 | 0.820 | 51 | 10.05 | 6.13 | 2.00 | 96.61 | 0.6592 | 2.92 | 0.360 |
| 55 | 23.302 | 2.063 | 0.025 | 0.055 | 6.120 | 0.094 | 0.170 | 10.075 | 0.008 | 0.060 | 0.000 | 0.000 | 0.007 | 0.021 | 0.000 | 53 | 10.25 | 6.21 | 2.23 | 95.80 | 0.7442 | 2.48 | 0.223 |
| 61 | 23.058 | 1.053 | 0.039 | 0.023 | 6.399 | 0.102 | 0.378 | 10.298 | 0.009 | 0.030 | 0.000 | 0.000 | 0.012 | 0.034 | 0.565 | 54 | 10.45 | 6.50 | 2.00 | 93.79 | 0.6978 | 2.73 | 0.302 |
| 63 | 23.616 | 1.798 | 0.002 | 0.003 | 6.138 | 0.004 | 0.011 | 10.207 | 0.002 | 0.023 | 0.000 | 0.000 | 0.000 | 0.006 | 0.187 | 55 | 10.24 | 6.14 | 2.00 | 95.77 | 0.8297 | 1.85 | 0.030 |
| 62 | 23.810 | 2.168 | 0.007 | 0.000 | 5.889 | 0.038 | 0.014 | 10.003 | 0.007 | 0.011 | 0.000 | 0.000 | 0.010 | 0.043 | 0.000 | 56 | 10.08 | 5.93 | 2.18 | 94.86 | 0.8466 | 1.69 | -0.019 |
| 60 | 23.475 | 1.583 | 0.018 | 0.000 | 6.214 | 0.000 | 0.260 | 10.256 | 0.008 | 0.010 | 0.000 | 0.000 | 0.003 | 0.019 | 0.153 | 57 | 10.31 | 6.21 | 2.00 | 94.31 | 0.7938 | 2.14 | 0.121 |
| 90 | 23.269 | 1.343 | 0.045 | 0.017 | 6.274 | 0.082 | 0.197 | 10.210 | 0.044 | 0.021 | 0.000 | 0.000 | 0.005 | 0.031 | 0.460 | 58 | 10.37 | 6.36 | 2.00 | 94.59 | 0.7497 | 2.44 | 0.213 |
| 58 | 23.853 | 1.694 | 0.007 | 0.000 | 6.104 | 0.000 | 0.006 | 9.999 | 0.010 | 0.023 | 0.000 | 0.000 | 0.000 | 0.000 | 0.304 | 59 | 10.04 | 6.10 | 2.00 | 97.77 | 0.8221 | 1.92 | 0.051 |
| 57 | 23.695 | 1.332 | 0.019 | 0.007 | 6.137 | 0.042 | 0.178 | 10.028 | 0.016 | 0.043 | 0.000 | 0.000 | 0.000 | 0.011 | 0.493 | 60 | 10.12 | 6.18 | 2.00 | 97.11 | 0.7405 | 2.5 | 0.230 |
| 59 | 23.845 | 1.059 | 0.021 | 0.000 | 6.125 | 0.000 | 0.173 | 9.950 | 0.029 | 0.011 | 0.000 | 0.000 | 0.001 | 0.015 | 0.771 | 61 | 10.03 | 6.12 | 2.00 | 96.68 | 0.7657 | 2.34 | 0.182 |
| 56 | 23.193 | 1.323 | 0.000 | 0.002 | 6.370 | 0.000 | 0.164 | 10.409 | 0.010 | 0.012 | 0.000 | 0.000 | 0.000 | 0.007 | 0.512 | 62 | 10.44 | 6.37 | 2.00 | 94.46 | 0.7940 | 2.14 | 0.121 |

| [1]Anal. No. | [2]Atoms per formula unit | | | | | | | | | | | | | | | [3]Auto-Scan No. | Total Ca site (10) | Total P site (6) | Total F+Cl+OH (2) | wt% totals | [4]$r_{mro}$ | [5]calc. Dpar (μm) | [5]calc. Cl (apfu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | [a]OH | | | | | | | | |
| **f0086011b: age mount #2** | | | | | | | | | | | | | | | | | | | | | | | |
| 107 | 24.223 | 0.860 | 0.002 | 0.022 | 5.745 | 0.007 | 0.080 | 9.935 | 0.005 | 0.048 | 0.000 | 0.000 | 0.000 | 0.013 | 1.059 | 1 | 10.02 | 5.75 | 2.00 | 101.14 | 0.7346 | 2.53 | 0.241 |
| 105 | 24.113 | 1.146 | 0.029 | 0.034 | 5.768 | 0.024 | 0.112 | 9.918 | 0.011 | 0.059 | 0.000 | 0.002 | 0.008 | 0.037 | 0.741 | 3 | 10.10 | 5.79 | 2.00 | 99.68 | 0.7089 | 2.68 | 0.285 |
| 102 | 24.138 | 0.991 | 0.000 | 0.003 | 5.890 | 0.023 | 0.122 | 9.898 | 0.010 | 0.035 | 0.000 | 0.000 | 0.001 | 0.006 | 0.884 | 5 | 9.95 | 5.91 | 2.00 | 101.22 | 0.7488 | 2.45 | 0.215 |
| 101 | 24.380 | 0.857 | 0.013 | 0.000 | 5.826 | 0.018 | 0.153 | 9.689 | 0.025 | 0.014 | 0.000 | 0.016 | 0.000 | 0.021 | 0.989 | 6 | 9.78 | 5.84 | 2.00 | 102.19 | 0.7548 | 2.41 | 0.203 |
| 100 | 24.018 | 1.049 | 0.053 | 0.009 | 5.873 | 0.080 | 0.393 | 9.873 | 0.026 | 0.025 | 0.000 | 0.003 | 0.016 | 0.029 | 0.554 | 7 | 10.03 | 5.95 | 2.00 | 98.36 | 0.6909 | 2.77 | 0.313 |
| 104 | 24.466 | 1.485 | 0.000 | 0.000 | 5.623 | 0.000 | 0.015 | 9.797 | 0.005 | 0.032 | 0.000 | 0.030 | 0.005 | 0.045 | 0.498 | 8 | 9.91 | 5.62 | 2.00 | 101.07 | 0.7976 | 2.12 | 0.112 |
| 103 | 23.850 | 1.319 | 0.005 | 0.000 | 6.008 | 0.014 | 0.067 | 10.075 | 0.008 | 0.021 | 0.000 | 0.003 | 0.003 | 0.017 | 0.611 | 9 | 10.13 | 6.02 | 2.00 | 99.54 | 0.7968 | 2.12 | 0.114 |
| 108 | 24.621 | 0.894 | 0.076 | 0.007 | 5.487 | 0.107 | 0.333 | 9.648 | 0.005 | 0.017 | 0.007 | 0.000 | 0.000 | 0.024 | 0.774 | 10 | 9.78 | 5.59 | 2.00 | 102.15 | 0.7220 | 2.61 | 0.263 |
| 99 | 24.326 | 0.926 | 0.000 | 0.000 | 5.809 | 0.026 | 0.179 | 9.728 | 0.008 | 0.029 | 0.000 | 0.006 | 0.028 | 0.042 | 0.895 | 11 | 9.84 | 5.83 | 2.00 | 101.71 | 0.7376 | 2.52 | 0.236 |
| 98 | 24.174 | 1.648 | 0.017 | 0.001 | 5.753 | 0.134 | 0.039 | 9.845 | 0.011 | 0.025 | 0.000 | 0.003 | 0.011 | 0.027 | 0.312 | 12 | 9.94 | 5.89 | 2.00 | 100.80 | 0.8095 | 2.02 | 0.083 |
| 106 | 24.622 | 0.249 | 0.048 | 0.091 | 5.380 | 0.086 | 0.194 | 9.644 | 0.011 | 0.065 | 0.038 | 0.000 | 0.000 | 0.013 | 1.558 | 13 | 9.91 | 5.47 | 2.00 | 100.08 | 0.6862 | 2.79 | 0.320 |
| 97 | 23.902 | 1.200 | 0.005 | 0.002 | 6.020 | 0.031 | 0.041 | 9.994 | 0.023 | 0.016 | 0.000 | 0.000 | 0.004 | 0.007 | 0.757 | 14 | 10.05 | 6.05 | 2.00 | 100.57 | 0.7944 | 2.14 | 0.120 |
| **f0086011: age mount #1** | | | | | | | | | | | | | | | | | | | | | | | |
| 115 | 23.861 | 0.896 | 0.016 | 0.018 | 5.937 | 0.000 | 0.020 | 10.102 | 0.022 | 0.036 | 0.000 | 0.003 | 0.000 | 0.008 | 1.081 | 1 | 10.21 | 5.94 | 2.00 | 100.17 | 0.7594 | 2.38 | 0.194 |
| 117 | 23.814 | 0.722 | 0.052 | 0.032 | 5.895 | 0.036 | 0.379 | 10.020 | 0.032 | 0.043 | 0.000 | 0.009 | 0.011 | 0.054 | 0.900 | 2 | 10.25 | 5.93 | 2.00 | 99.09 | 0.6071 | 3.14 | 0.427 |
| 110 | 24.335 | 0.968 | 0.016 | 0.029 | 5.609 | 0.000 | 0.117 | 9.933 | 0.007 | 0.056 | 0.000 | 0.000 | 0.000 | 0.018 | 0.913 | 3 | 10.06 | 5.61 | 2.00 | 99.17 | 0.7080 | 2.68 | 0.286 |
| 113 | 24.702 | 1.673 | 0.000 | 0.004 | 5.302 | 0.000 | 0.000 | 9.861 | 0.000 | 0.014 | 0.000 | 0.021 | 0.026 | 0.070 | 0.326 | 5 | 10.00 | 5.30 | 2.00 | 100.05 | 0.8303 | 1.84 | 0.029 |
| 111 | 24.436 | 1.054 | 0.004 | 0.051 | 5.678 | 0.009 | 0.065 | 9.745 | 0.004 | 0.055 | 0.006 | 0.000 | 0.000 | 0.015 | 0.878 | 6 | 9.88 | 5.69 | 2.00 | 100.63 | 0.7275 | 2.58 | 0.253 |
| 112 | 24.453 | 0.777 | 0.003 | 0.004 | 5.547 | 0.000 | 0.022 | 9.959 | 0.002 | 0.018 | 0.000 | 0.000 | 0.000 | 0.013 | 1.202 | 7 | 10.00 | 5.55 | 2.00 | 100.39 | 0.8037 | 2.07 | 0.098 |
| 109 | 24.283 | 0.908 | 0.002 | 0.064 | 5.626 | 0.000 | 0.048 | 9.956 | 0.004 | 0.053 | 0.000 | 0.001 | 0.000 | 0.011 | 1.043 | 8 | 10.09 | 5.63 | 2.00 | 100.32 | 0.7299 | 2.56 | 0.249 |
| 114 | 24.432 | 0.937 | 0.008 | 0.010 | 5.626 | 0.000 | 0.209 | 9.830 | 0.018 | 0.037 | 0.000 | 0.005 | 0.004 | 0.032 | 0.851 | 9 | 9.95 | 5.63 | 2.00 | 100.95 | 0.7119 | 2.66 | 0.280 |
| 116 | 23.958 | 1.343 | 0.023 | 0.024 | 5.851 | 0.000 | 0.108 | 10.046 | 0.010 | 0.058 | 0.000 | 0.000 | 0.006 | 0.029 | 0.545 | 11 | 10.20 | 5.85 | 2.00 | 99.78 | 0.7298 | 2.56 | 0.249 |
| 118 | 24.127 | 0.918 | 0.010 | 0.089 | 5.815 | 0.005 | 0.180 | 9.884 | 0.007 | 0.058 | 0.000 | 0.000 | 0.000 | 0.007 | 0.900 | 12 | 10.06 | 5.82 | 2.00 | 100.83 | 0.6802 | 2.82 | 0.329 |
| 119 | 23.915 | 1.172 | 0.009 | 0.007 | 5.902 | 0.000 | 0.093 | 10.106 | 0.017 | 0.038 | 0.000 | 0.000 | 0.000 | 0.011 | 0.730 | 13 | 10.19 | 5.90 | 2.00 | 99.57 | 0.7549 | 2.41 | 0.203 |
| **f2098002: age mount #3** | | | | | | | | | | | | | | | | | | | | | | | |
| 143 | 24.642 | 1.902 | 0.019 | 0.001 | 5.656 | 0.065 | 0.005 | 9.564 | 0.006 | 0.032 | 0.003 | 0.000 | 0.000 | 0.008 | 0.097 | 1 | 9.63 | 5.72 | 2.00 | 102.26 | 0.8222 | 1.92 | 0.051 |
| 142 | 24.518 | 1.906 | 0.010 | 0.000 | 5.760 | 0.016 | 0.026 | 9.631 | 0.018 | 0.015 | 0.000 | 0.031 | 0.000 | 0.000 | 0.069 | 2 | 9.71 | 5.78 | 2.00 | 101.72 | 0.8333 | 1.82 | 0.020 |
| 473 | 23.508 | 1.291 | 0.022 | 0.107 | 6.155 | 0.007 | 0.137 | 10.067 | 0.012 | 0.039 | 0.059 | 0.000 | 0.002 | 0.020 | 0.575 | 3 | 10.33 | 6.16 | 2.00 | 94.28 | 0.7391 | 2.51 | 0.233 |
| 154 | 24.788 | 1.647 | 0.033 | 0.084 | 5.618 | 0.019 | 0.116 | 9.339 | 0.011 | 0.048 | 0.008 | 0.000 | 0.010 | 0.037 | 0.241 | 4 | 9.57 | 5.64 | 2.00 | 102.41 | 0.7547 | 2.41 | 0.203 |
| 153 | 24.483 | 1.652 | 0.027 | 0.025 | 5.759 | 0.023 | 0.098 | 9.593 | 0.013 | 0.051 | 0.007 | 0.000 | 0.002 | 0.020 | 0.249 | 5 | 9.74 | 5.78 | 2.00 | 101.94 | 0.7614 | 2.37 | 0.190 |
| 152 | 24.393 | 2.057 | 0.040 | 0.005 | 5.769 | 0.020 | 0.031 | 9.577 | 0.025 | 0.017 | 0.000 | 0.016 | 0.010 | 0.040 | 0.000 | 6 | 9.73 | 5.79 | 2.09 | 101.40 | 0.8254 | 1.89 | 0.042 |
| 149 | 24.497 | 1.565 | 0.031 | 0.021 | 5.750 | 0.000 | 0.084 | 9.591 | 0.013 | 0.041 | 0.000 | 0.014 | 0.006 | 0.033 | 0.352 | 7 | 9.75 | 5.75 | 2.00 | 100.54 | 0.7707 | 2.31 | 0.171 |
| 151 | 24.266 | 1.879 | 0.001 | 0.000 | 5.816 | 0.000 | 0.006 | 9.852 | 0.002 | 0.017 | 0.000 | 0.016 | 0.006 | 0.019 | 0.120 | 8 | 9.91 | 5.82 | 2.00 | 98.98 | 0.8392 | 1.76 | 0.003 |
| 156 | 24.430 | 1.012 | 0.005 | 0.062 | 5.808 | 0.029 | 0.121 | 9.577 | 0.011 | 0.065 | 0.000 | 0.000 | 0.001 | 0.008 | 0.871 | 10 | 9.73 | 5.84 | 2.00 | 101.38 | 0.6891 | 2.78 | 0.316 |
| 157 | 24.174 | 0.863 | 0.006 | 0.002 | 5.844 | 0.017 | 0.104 | 9.912 | 0.012 | 0.015 | 0.000 | 0.000 | 0.005 | 0.011 | 1.036 | 11 | 9.96 | 5.86 | 2.00 | 99.50 | 0.7752 | 2.28 | 0.162 |
| 158 | 23.649 | 1.210 | 0.014 | 0.009 | 5.926 | 0.000 | 0.234 | 10.278 | 0.020 | 0.051 | 0.000 | 0.006 | 0.006 | 0.038 | 0.561 | 12 | 10.42 | 5.93 | 2.00 | 94.63 | 0.6984 | 2.73 | 0.302 |
| 144 | 24.307 | 1.187 | 0.010 | 0.003 | 5.890 | 0.023 | 0.054 | 9.741 | 0.010 | 0.012 | 0.000 | 0.000 | 0.000 | 0.003 | 0.760 | 13 | 9.78 | 5.91 | 2.00 | 100.77 | 0.8032 | 2.07 | 0.099 |
| 137 | 24.346 | 1.248 | 0.030 | 0.019 | 5.884 | 0.000 | 0.229 | 9.618 | 0.018 | 0.035 | 0.007 | 0.001 | 0.009 | 0.031 | 0.526 | 15 | 9.77 | 5.88 | 2.00 | 100.31 | 0.7308 | 2.56 | 0.248 |
| 138 | 24.449 | 0.946 | 0.100 | 0.029 | 5.626 | 0.320 | 0.099 | 9.394 | 0.018 | 0.046 | 0.000 | 0.000 | 0.000 | 0.019 | 0.954 | 16 | 9.61 | 5.95 | 2.00 | 101.61 | 0.7124 | 2.66 | 0.279 |
| 136 | 24.051 | 1.317 | 0.011 | 0.064 | 6.009 | 0.000 | 0.135 | 9.772 | 0.010 | 0.067 | 0.000 | 0.000 | 0.001 | 0.012 | 0.551 | 17 | 9.94 | 6.01 | 2.00 | 99.16 | 0.7038 | 2.7 | 0.293 |
| 135 | 24.498 | 1.278 | 0.012 | 0.009 | 5.861 | 0.000 | 0.188 | 9.539 | 0.017 | 0.044 | 0.000 | 0.000 | 0.000 | 0.016 | 0.539 | 18 | 9.64 | 5.86 | 2.00 | 101.70 | 0.7323 | 2.55 | 0.245 |
| 133 | 24.497 | 1.907 | 0.005 | 0.002 | 5.729 | 0.043 | 0.004 | 9.652 | 0.017 | 0.015 | 0.000 | 0.032 | 0.000 | 0.004 | 0.093 | 19 | 9.73 | 5.77 | 2.00 | 100.73 | 0.8364 | 1.79 | 0.011 |

| [1]Anal. No. | O | F | Na | Mg | P | S | Cl | Ca | Mn | Fe | Sr | Y | La | Ce | [a]OH | [3]Auto-Scan No. | Total Ca site (10) | Total P site (6) | Total F+Cl+OH (2) | wt% totals | [4]$r_{mro}$ | [5]calc. Dpar (µm) | [5]calc. Cl (apfu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [2]Atoms per formula unit | | | | | | | | | | | | | | | | | | | | | | |
| 132 | 22.493 | 0.699 | 0.041 | 0.048 | 6.415 | 0.000 | 0.588 | 10.865 | 0.021 | 0.054 | 0.017 | 0.000 | 0.012 | 0.034 | 0.712 | 20 | 11.09 | 6.41 | 2.00 | 87.07 | 0.4670 | 3.61 | 0.572 |
| 165 | 27.329 | 1.534 | 0.106 | 0.014 | 4.637 | 0.000 | 0.189 | 7.812 | 0.020 | 0.063 | 0.000 | 0.000 | 0.000 | 0.020 | 0.275 | 22 | 8.04 | 4.64 | 2.00 | 78.88 | 0.7034 | 2.71 | 0.294 |
| 166 | 24.303 | 1.410 | 0.017 | 0.021 | 5.908 | 0.000 | 0.147 | 9.691 | 0.007 | 0.035 | 0.000 | 0.003 | 0.000 | 0.020 | 0.439 | 23 | 9.79 | 5.91 | 2.00 | 99.59 | 0.7671 | 2.33 | 0.179 |
| 167 | 24.625 | 1.998 | 0.004 | 0.064 | 5.807 | 0.000 | 0.032 | 9.390 | 0.008 | 0.048 | 0.012 | 0.000 | 0.000 | 0.011 | 0.000 | 24 | 9.54 | 5.81 | 2.03 | 101.61 | 0.7953 | 2.13 | 0.118 |
| 168 | 25.148 | 1.383 | 0.038 | 0.000 | 5.603 | 0.000 | 0.298 | 9.141 | 0.016 | 0.016 | 0.000 | 0.000 | 0.008 | 0.030 | 0.319 | 25 | 9.25 | 5.60 | 2.00 | 102.47 | 0.7595 | 2.38 | 0.194 |
| 163 | 24.673 | 1.523 | 0.015 | 0.000 | 5.765 | 0.000 | 0.042 | 9.499 | 0.012 | 0.013 | 0.000 | 0.000 | 0.000 | 0.020 | 0.439 | 26 | 9.56 | 5.76 | 2.00 | 101.47 | 0.8186 | 1.95 | 0.060 |
| 164 | 24.448 | 1.061 | 0.039 | 0.070 | 5.805 | 0.013 | 0.337 | 9.541 | 0.020 | 0.044 | 0.004 | 0.005 | 0.000 | 0.006 | 0.606 | 27 | 9.73 | 5.82 | 2.00 | 100.33 | 0.6684 | 2.88 | 0.346 |
| 169 | 24.931 | 0.689 | 0.005 | 0.011 | 5.664 | 0.000 | 0.486 | 9.305 | 0.020 | 0.034 | 0.001 | 0.000 | 0.004 | 0.020 | 0.829 | 29 | 9.40 | 5.66 | 2.00 | 102.67 | 0.6209 | 3.09 | 0.410 |
| 170 | 24.612 | 0.572 | 0.021 | 0.008 | 5.817 | 0.029 | 0.627 | 9.437 | 0.021 | 0.042 | 0.000 | 0.000 | 0.000 | 0.011 | 0.803 | 32 | 9.54 | 5.85 | 2.00 | 101.61 | 0.5128 | 3.47 | 0.529 |
| 474 | 23.762 | 1.070 | 0.039 | 0.029 | 6.030 | 0.012 | 0.254 | 9.997 | 0.020 | 0.041 | 0.008 | 0.000 | 0.013 | 0.047 | 0.677 | 33 | 10.19 | 6.04 | 2.00 | 95.01 | 0.6942 | 2.75 | 0.308 |
| 159 | 24.440 | 2.387 | 0.002 | 0.012 | 5.578 | 0.025 | 0.016 | 9.483 | 0.001 | 0.047 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 34 | 9.55 | 5.60 | 2.40 | 103.57 | 0.8088 | 2.03 | 0.085 |
| 162 | 24.800 | 1.614 | 0.025 | 0.001 | 5.631 | 0.087 | 0.028 | 9.425 | 0.002 | 0.021 | 0.002 | 0.000 | 0.000 | 0.007 | 0.358 | 35 | 9.48 | 5.72 | 2.00 | 102.69 | 0.8196 | 1.94 | 0.058 |
| 161 | 24.888 | 1.261 | 0.081 | 0.021 | 5.529 | 0.065 | 0.136 | 9.272 | 0.028 | 0.019 | 0.008 | 0.001 | 0.021 | 0.068 | 0.603 | 37 | 9.52 | 5.59 | 2.00 | 102.36 | 0.7612 | 2.37 | 0.191 |
| 160 | 24.657 | 1.501 | 0.015 | 0.000 | 5.724 | 0.000 | 0.047 | 9.568 | 0.006 | 0.015 | 0.000 | 0.000 | 0.003 | 0.015 | 0.449 | 39 | 9.62 | 5.72 | 2.00 | 101.87 | 0.8168 | 1.96 | 0.065 |
| 146 | 24.540 | 1.675 | 0.030 | 0.088 | 5.741 | 0.026 | 0.115 | 9.481 | 0.006 | 0.043 | 0.007 | 0.000 | 0.007 | 0.029 | 0.213 | 40 | 9.69 | 5.77 | 2.00 | 102.27 | 0.7686 | 2.32 | 0.176 |
| 150 | 24.444 | 1.725 | 0.024 | 0.002 | 5.691 | 0.145 | 0.076 | 9.653 | 0.001 | 0.016 | 0.016 | 0.000 | 0.000 | 0.008 | 0.199 | 43 | 9.72 | 5.84 | 2.00 | 100.78 | 0.8239 | 1.9 | 0.046 |
| 148 | 24.827 | 1.846 | 0.061 | 0.070 | 5.653 | 0.026 | 0.128 | 9.239 | 0.011 | 0.040 | 0.010 | 0.000 | 0.013 | 0.049 | 0.028 | 44 | 9.49 | 5.68 | 2.00 | 103.36 | 0.7747 | 2.28 | 0.163 |
| 155 | 24.517 | 1.333 | 0.010 | 0.002 | 5.757 | 0.023 | 0.155 | 9.634 | 0.013 | 0.017 | 0.005 | 0.000 | 0.003 | 0.018 | 0.512 | 48 | 9.70 | 5.78 | 2.00 | 100.10 | 0.7852 | 2.21 | 0.140 |
| 134 | 24.156 | 0.890 | 0.000 | 0.001 | 5.912 | 0.000 | 0.262 | 9.869 | 0.016 | 0.027 | 0.000 | 0.000 | 0.002 | 0.014 | 0.850 | 49 | 9.93 | 5.91 | 2.00 | 99.93 | 0.7204 | 2.62 | 0.266 |
| 145 | 23.936 | 0.995 | 0.064 | 0.021 | 5.944 | 0.125 | 0.088 | 9.823 | 0.020 | 0.047 | 0.005 | 0.000 | 0.001 | 0.012 | 0.919 | 50 | 9.99 | 6.07 | 2.00 | 99.53 | 0.7198 | 2.62 | 0.267 |

[1]Number gives order in which apatite grains were probed; all microprobe analyses by A. Grist

[2]Calculated using wt% data of Table 3a; a - calculated assuming full occupancy of halogen site in apatite crystal

[3]Number used to locate apatite grains on age and length mounts

[4]Calculated from Cl, OH, Mn, Fe, Na, Mg, Sr, Y, Ce and La using equation 6 of Carlson *et al*. (1999)

[5]Calculated using $r_{mro}$ value and equations 4a,b of Ketcham *et al.* (2000)